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ABSTRACT

A study examined eight local consortia identified as mature Tech Prep implementers. The four-year research used a mixed-method longitudinal design involving repeated field visits, short and long interviews of key stakeholders, classroom observations, and document review and analysis. About 4,700 Tech Prep and non-Tech Prep participants were selected for a causal-comparative study of students' educational and employment outcomes, with 2 or 3 panels of high school graduates from 4 academic years per consortium. Mid-point findings showed Tech Prep centered on secondary education with goals and policies broadening and target populations shifting toward all students; consortia increasingly linked Tech Prep to state-level efforts to raise academic standards and enhance academic course-taking; core curriculum occurred in many forms, including starting at grade 9 rather than 11 and extending to the bachelor's degree; students' math course-taking varied across sites; teacher and counselor training was a prominent element in all consortia; preparatory services were conceptualized and implemented in different ways; all consortia experienced an increase in Tech Prep student enrollment; at least 65 percent of Tech Prep participants enrolled in some form of postsecondary education; and Tech Prep participants were more likely to be working. (Case studies of each consortium are provided. (Contains 17 references.) (YLB)

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Promising Outcomes for Tech Prep Participants in Eight Local Consortia:

A Summary of Initial Results

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Promising Outcomes For Tech Prep Participants In Eight Local Consortia: A Summary of Initial Results

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Debra D. Bragg, Project Director

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Executive Summary

Whereas some attention has been paid to evaluation of Tech Prep to document implementation, estimate enrollments, and ensure compliance with legislative requirements, little attention has been given to the relationship between Tech Prep implementation and student outcomes. To address this problem, eight local consortia were identified by a national panel of experts as mature implementers, and these consortia were engaged in a four-year longitudinal study, starting officially on January 1, 1998. This document reports mid-point findings of the study to provide greater understanding of how eight mature Tech Prep initiatives have been implemented, and how they have influenced student's educational experiences and outcomes, particularly transition to college and work.

The research utilizes a mixed-method (Creswell, 1994) longitudinal design involving repeated field visits, engaging key stakeholders in short and long interviews, classroom observations, and document review and analysis. Approximately 4,700 Tech Prep and non-Tech Prep participants were selected for a causal-comparative study of students' educational and employment outcomes, with two or three panels of high school graduates selected from the 1994-95, 1995-96, 1996-97, or 1997-98 academic years per consortium. Within each consortium about 600 high school graduates were selected, with about half of these being Tech Prep participants and the remaining being non-participants. Tech Prep participation was defined by the local consortium in accordance with their own local policies and practices rather than by an external mandate created for the purposes of conducting this research. This approach was taken because it capitalized on the variation in local implementation policies evident in national studies of Tech Prep implementation (Bragg, Layton, & Hammons, 1994; Hershey, Silverberg, Owens, & Hulsey, 1998).

Data were collected via high school and community college transcripts from well over 95 percent of participants providing high school and 40 percent having community college transcripts. (Transcript data were entered up through the summer 1998 term, which was between one and three years after high school graduation, for most study participants.) To supplement the field work and transcript data, a follow-up survey was conducted to identify attitudes toward high school, transition to college plans and actual experiences, and employment during and after high school. Between 38 and 62 percent of the sample of students in each consortium provided useable data, providing an overall return rate of 47 percent.

Results show Tech Prep centered on secondary education with goals and policies broadening and target populations shifting toward all students, especially as School-To-Work (STW) Opportunities legislation came about. Consortia also increasingly linked Tech Prep to state-level efforts to raise academic standards and enhance academic course-taking as the 1990s proceeded. Whether consortium administrators were headquartered within a community college or at the secondary level where they were affiliated with a regional vocational entity, they sometimes lacked the authority to bring about changes in comprehensive high schools consistent with full-scale implementation of Tech Prep. Even so, by showing savvy leadership and involving a broad cadre of educational, business, and community leaders, Tech Prep leaders were influential at generating the momentum needed to move Tech Prep ahead, though plans were sometimes slowed or halted when other priorities were elevated above Tech Prep. In several consortia, it was business and industry that kept the focus on Tech Prep through an evolving governance structure involving chambers of commerce and eventually more sophisticated industry councils.

Block scheduling, joint planning, and integrated instruction along with scholarships for Tech Prep participants transitioning to college were other mechanisms that seemed to facilitate Tech Prep implementation and student participation.

The Perkins II and Perkins III legislation is clear about the importance of seven essential elements associated with Tech Prep implementation. These seven elements are: articulation agreements, 2+2 curriculum, curriculum development, training for teachers, training for counselors, preparatory services, and equal access for all learners. Of these seven, articulation agreements provide the foundation for Tech Prep by creating the curricular structure to extend the educational pathway to the postsecondary level for more students. The articulation process has been beneficial to stimulating a dialogue among secondary and postsecondary educators around content and standards, and in the creation of new sequences of CTE courses. Articulation has been elevated to state-level status in a few states engaged in this study, to attempt to strengthen opportunities for youths to make a smooth transition to college. Even so, students often do not access the college credits they accumulate during high school. There are many reasons for this, including a lack of awareness that courses have generated college credit but also a lack of confidence in high school preparation.

Core curriculum occurs in many forms, including starting at grade nine rather than eleven, and extending to the bachelor's degree rather than ending at the associate level. Linked to these approaches, consortia utilize different forms of Tech Prep (Hershey, Silverberg, Owens, and Hulsey, 1998). These forms include structured, comprehensive programs for selected student groups, vocational Tech Prep programs for students who have traditionally participated in vocational education options, and non-targeted approaches that rely on a hodgepodge of strategies, only loosely tied together for the purposes of Tech Prep. Of these three forms, the eight selected consortia displayed extensive evidence of the vocational Tech Prep form, and some indication of the comprehensive, structured model, but none of the consortia were indicative of the non-targeted approach. In addition to these, models of Tech Prep described by Bragg (1995) were evident in the form of work-based Tech Prep, specifically represented in the Tech Prep/Youth Apprenticeship (TP/YA) programs, and the Integrated Tech Prep approach where extensive emphasis is placed on locally-developed academic and CTE integration. One other model was represented and that was the College Tech Prep model, emphasizing academics that meet the four-year college and university admission requirements in the state. The College Tech Prep model was used extensively in one consortium, and representative of the curriculum pursued by some but not all Tech Prep participants in two other sites.

Academic course-taking was examined as a part of this study, and we learned that students' math course-taking varied across the eight sites. In half the consortia, well over one-half of the Tech Prep participants started high school below Algebra I (usually a higher percentage than for their non-Tech Prep counterparts). By high school graduation, nearly all had completed Algebra I and some finished more advanced math courses. In two consortia where the majority of Tech Prep participants started below Algebra I, the majority had completed Algebra II or above by high school graduation, which is an impressive accomplishment. In the remaining half of consortia where most students began high school by taking Algebra I, these students were highly likely to complete advanced math at the Algebra II or more advanced level by high school graduation. In addition to academic course-taking, most consortia offered an array of new technology-based programs to attract students who might not participate in traditional CTE

courses, in addition to long-standing CTE programs. Career clusters were implemented in all consortia in the mid- to late-1990s, and these pathways led to new pathways leading to college.

Training for teachers and counselors was a prominent element in all eight consortia. Over time, participants in professional in-service included a much more diverse group of academic and CTE teachers and counselors across the secondary and postsecondary levels. Parents, business and industry representatives, community leaders, and sometimes students were involved occasionally. Also over time, as Tech Prep shifted from the awareness and planning stages to full-scale implementation, professional development was used to encourage and support its evolution. Local business and industry played an increasingly prominent role in in-service, including providing training within local firms so that educational personnel could gain greater understanding of technical jobs and the modern work world.

Preparatory services were conceptualized and implemented in different ways, ranging from career exploration and guidance to providing mentoring to offering remedial and developmental education to students entering the postsecondary level. Increasingly, most consortia heightened attention to "college readiness", preparing students for college placement tests and sharpening their study skills, while they were still in high school. These services facilitate the emphasis of Tech Prep on addressing the needs of all learners, including neglected majority students. Increasingly, Tech Prep has taken on an even more encompassing perspective, with most consortia encouraging students at any point on the academic ability continuum to participate in some way. Results suggest that, in most consortia, Tech Prep participants were similarly distributed on race/ethnicity and gender as the comparison group drawn from the general student population. In three consortia, a higher percentage of Tech Prep participants than the non-Tech Prep group reported family income below $30,000 and parental education less than college level, suggesting Tech Prep participants represented a lower socioeconomic status (SES) group and were more likely to be first-generation college.

Since beginning Tech Prep in the early 1990s or earlier, all consortia have experienced an increase in student enrollment in Tech Prep. Enhanced implementation activities involving more teachers, greater emphasis on guidance, more integrated instruction, and heightened recruitment are only a few of the specific strategies that have been employed to help the Tech Prep programs grow in size and scope. On average, Tech Prep enrolled about 15 percent of the high school students in these selected consortia during the 1996-97 academic year, and have undoubtedly grown more since that time. (During the current field work, we plan to update the consortia enrollment figures through the 1999-2000 academic year.)

Transition to college and work are important outcomes investigated as a part of this study. Indeed, results show that a high percentage of Tech Prep participants continue on to postsecondary education of some type after high school graduation. Results suggest that, across all eight consortia, at least 65 percent of Tech Prep participants enrolled in some form of postsecondary education within one and three years of high school graduation. In fact, the percentage of Tech Prep participants entering college exceeded 75 percent in five of the eight consortia. In all but one consortium a higher percentage of Tech Prep participants enrolled in two-year college than their non-Tech Prep peers, though the difference was usually modest. Some Tech Prep participants enrolled in four-year college, and in the case of two consortia, the percentage pursuing this option was quite extensive, approaching or exceeding 50 percent.

Further analysis will be done to determine if the College Tech Prep model emphasizing four-year college and university requirements is associated with this transition pattern.

Work was an important part of the lives of Tech Prep participants, whether or not they attended college after high school. Tech Prep participants were more likely than non-Tech Prep participants to be working; of those working in both groups, Tech Prep participants were more likely to be working full-time. This pattern was not evident in all consortia, but it was a predominant pattern in several. Within consortia, results show promising outcomes linked to wage increases over time for Tech Prep participants and also the acquisition of more highly skilled and technical jobs. Because the timeframe for our initial data collection was relatively short (one to three years post-high school), it was not possible to see the impact of college completion and credentials on subsequent employment, but this question is of utmost importance to our future analysis. Additional study will also be focused on qualitative and quantitative data essential to understanding the decisions youths make in moving out into the world as young adults. Reliable estimates of Tech Prep enrollment at the postsecondary level are difficult to ascertain, but knowledge of student participation in the entire curriculum is essential to determining the success of Tech Prep. Our data set is uniquely capable of answering questions pertaining to transition to college and work, and our future efforts will be dedicated toward this end goal.

INTRODUCTION

Since passage of federal legislation authorizing development of Tech Prep in the United States, numerous studies have been conducted to better understand planning and implementation (see, for example, Dornsife, 1992; Bragg, Layton, & Hammons, 1994; Grubb et al., 1996; Hershey, Silverberg, Owens, & Hulsey, 1998; and Orr, 1999). Drawing on this literature and the expertise of several of these researchers, beginning in January 1998, the Office of Vocational and Adult Education (OVAE), United States Department of Education (USDE) supported a study focused on Tech Prep implementation and student outcomes. Results of the first two years of the study was published by the National Center for Research in Vocational Education (NCRVE), University of California at Berkeley, in a document entitled, *Tech Prep Implementation: Preliminary Student Outcomes for Eight Local Tech Prep Consortia* (Bragg et al., 1999). Currently, this document is available from the National Dissemination Center for Career and Technical Education (NDCCTE) at The Ohio State University and on the website at www.nccte.com.

The original *Tech Prep Implementation: Preliminary Student Outcomes* report provided a conceptual framework, literature review, and detailed description of each of the eight consortia engaged in Tech Prep implementation since the early 1990s or before, including preliminary results associated with students' educational experiences and outcomes. Based largely on this earlier report, this particular document highlights major findings for the eight local consortia, both in terms of cross-site comparisons and individual consortium results. Not intended to be exhaustive, this document summarizes major findings so as to disseminate the preliminary results to a wider audience of policy makers and practitioners. In fact, if details are needed, readers are encouraged to obtain the original report. By keeping this document concise, we hope to provide a brief account of the research completed thus far, suggesting emerging themes and promising avenues for future analysis.

Background

Passage of the Tech Prep Education Act, as part of the Carl D. Perkins Vocational and Applied Technology Act of 1990 (commonly known as Perkins II), gave attention to an educational reform called Technical Preparation (Tech Prep). The Perkins II law encouraged Tech Prep planning and implementation through federal grants awarded to states beginning in 1991 to establish local consortia dedicated to creating articulated secondary and postsecondary curriculum. Based mostly on articulation agreements between high schools and community colleges, the Tech Prep model relied on the development and execution of 2+2 core curriculum, signifying that the last two years of high school would provide a seamless transition to the first two years of college.

Tech Prep was also intended to be a vehicle for integrating academic and vocational content. Though small in scale relative to funding for vocational education overall, Tech Prep emphasized the integration and restructuring of academic and vocational curricula. Reauthorization of vocational legislation in 1998 (Perkins III) reinforced a commitment to Tech Prep with its emphasis on articulation to postsecondary education and curriculum integration. In addition to these foci, Perkins III placed greater emphasis on changing instructional strategies at both the secondary and postsecondary levels, encouraging contextual teaching and learning, along with work-based learning (WBL). Perkins III also supported the idea of articulation of Tech Prep

programs with baccalaureate-degree curricula. Table 1 provides a comparison the essential elements represented in the Perkins II and Perkins III legislation. [Note that current research activities by the author and her colleagues are focused on investigating changes in local Tech Prep implementation since passage of Perkins III, and these results will be summarized in a forthcoming report for the National Research Center for Career and Technical Education (NRCCTE) in Fall 2001.]

Table 1

Essential Elements of Tech Prep in the Perkins II and Perkins III Legislation

Perkins II (1990)	Perkins III (1998)
1. Articulation agreement between the participants in the consortium	1. Articulation agreement between the participants in the consortium
2. Two years of secondary school preceding graduation and two years of higher education, or an apprenticeship of at least two years following secondary instruction, with a common core of required proficiency in math, science, communications, and technologies designed to lead to an associate degree or certificate in a specific career field.	2. Two years of secondary school preceding graduation and two years or more of higher education, or an apprenticeship program of at least two years following secondary instruction, with a common core of required proficiency in math, science, reading, writing, communications, and technologies designed to lead to an associates degree or a postsecondary certificate in a specific career field
3. Include the development of Tech Prep program curricula appropriate to the needs of consortium participants	3. Include the development of Tech Prep programs for both secondary and postsecondary, including consortium, participants in the consortium that– (A) meets academic standards developed by the State; (B) links secondary schools and 2-year postsecondary institutions, and if possible and practicable, 4-year institutions of higher education through nonduplicative sequences of courses in career fields, including the investigation of opportunities for Tech Prep secondary students to enroll concurrently in secondary and postsecondary coursework; (C) uses, if appropriate and available, work-based or worksite learning in conjunction with business and all aspects of an industry; and (D) uses educational technology and distance learning, as appropriate, to involve all the consortium partners more fully in the development and operation of programs.

Table 1 (continued)

4. Include in-service training for teachers that– (A) is designed to train teachers to implement Tech Prep; (B) provides for joint training for teachers from all participants in the consortium; and (C) may provide such training on weekend, evening, summer, or workshops.	4. Include in-service training for teachers that– (A) is designed to train vocational and technical teachers to effectively implement Tech Prep programs; (B) provides for joint training for teachers in the Tech Prep consortium; (C) is designed to ensure that teachers and administrators stay current with the needs, expectations, and methods of business and all aspects of an industry; (D) focuses on training postsecondary education faculty in the use of contextual and applied curricula and instruction; and (E) provides training in the use and application of technology;
5. Include training programs for counselors designed to enable counselors to more effectively– (A) recruit students for Tech Prep, (B) ensure that such students successfully complete such programs, and (C) ensure that such students are placed in appropriate employment.	5. Include training programs for counselors designed to enable counselors to more effectively– (A) provide information to students regarding Tech Prep education programs; (B) support student progress in completing Tech Prep programs; (C) provide information on related employment opportunities; (D) ensure that such students are placed in appropriate employment; and (E) stay current with the needs, expectations, and methods of business and all aspects of an industry.
6. Provide equal access to the full range of Tech Prep programs to individuals who are members of special populations, including the development of Tech Prep services appropriate to the needs of such individuals; and	6. Provide equal access, to the full range of technical preparation programs, to individuals who are members of special populations, including the development of Tech Prep program services appropriate to the needs of special populations; and
7. Provide for preparatory services which assist all participants in such programs.	7. Provide for preparatory services that assist participants in Tech Prep programs.

Source: Carl D. Perkins Vocational and Applied Technology Education Act Amendments of 1990 and 1998.

The Status of Tech Prep

During the decade of the 1990s, Tech Prep programs proliferated and student participation grew (see, for example, Hershey et al., 1998; Orr, 1998; and Silverberg, 1996b). By the fall of 1995, Tech Prep was offered in well over half of the comprehensive high schools and the vast majority of community colleges in the United States (Bragg et al., 1997; Silverberg, 1996a). Precise enrollment statistics have not been available on a national level since completion of the national evaluation of Tech Prep sponsored by OVAE. However, some states have reported fairly sizeable growth in student participation, particularly during the past five years. To name a few, the states of Florida, Illinois, and Texas have documented Tech Prep enrollment increases of between 8 and 30 percent between 1995 and 1999 (Bragg, 2000; Brown, forthcoming).

Even though enrollments are increasing, Tech Prep implementation has experienced difficulties. Concerns about unclear goals and ambiguous definitions for Tech Prep programs and student participants have been pervasive (see, for example, Elliott, 2000), and have been associated with many approaches to and criticisms of Tech Prep. Further, studies conducted by Hershey et al. (1998), Bragg et al. (1999), Orr (1998); and Prestine and Bragg (1998) have pointed to the uneasy fit between Tech Prep and other K-12 school reforms, including the School-To-Work Opportunities Act (STWOA) and Coalition of Essential Schools initiatives. An earlier study by Bragg et al. (1994) pointed to various barriers to local implementation such as lacking planning time between academic and vocational faculty at the secondary and postsecondary levels, the failure of four-year colleges and universities to recognize applied curriculum as legitimate preparation for college, lack of general awareness about Tech Prep, and limited staff, time and money to support proposed changes. Whereas some of these concerns have become less pronounced over time, many have remained (Bragg et al., 1997; Hershey et al., 1998). Consequently, local consortia experienced continuing challenges as they attempted to extend and deepen Tech Prep as a means of creating improved learning experiences for more students seeking postsecondary, typically two-year college, educational opportunities.

Research Objectives

Considering the magnitude of the federal commitment to Tech Prep, research was needed to gain greater understanding of how local Tech Prep initiatives have been implemented and how they have influenced student's educational experiences and outcomes, particularly their transitions to postsecondary education and work. Whereas some attention has been paid to evaluation of Tech Prep to document implementation, estimate enrollments, and ensure compliance with legislative requirements, little attention has been given to the relationship between Tech Prep implementation and student outcomes. To address this problem, eight local consortia were identified by a national panel of experts as mature implementers and these consortia have been engaged in the study since at least January 1998. This initial phase of the study was guided by three objectives and several related questions:

1. *To provide an in-depth description of selected local Tech Prep initiatives, focusing on implementation policies and practices designed to enhance student transition from high school to postsecondary education and work.* Questions linked to this objective are: What is the local and state context for Tech Prep implementation? What goals, policies, and definitions are established for Tech Prep, and how are these related to school-to-work (STW), vocational education, and other educational reforms? How does Tech Prep operate

at the local level, and what are its predominant components? What core curricular elements are pervasive at the secondary and postsecondary levels? How has Tech Prep evolved since its initial implementation in the early 1990s (or before), and what major milestones are evident in its continued implementation?

2. *To document the educational experiences and outcomes of student participants in local Tech Prep systems, and compare those experiences and outcomes to a comparable group of non-participants.* Questions related to this objective include: What are selected demographic, personal and educational characteristics of Tech Prep high school graduates (also referred to as Tech Prep participants), and how do they compare to non-participants? What are participants' course-taking patterns in the secondary curriculum and how do they compare to non-participants? How do participants and non-participants make the transition from secondary to postsecondary education and work? What are the employment experiences of participants and non-participants during high school and after graduation?

3. *To examine the various qualitative dimensions of students' experiences in Tech Prep, developing a richer and deeper understanding of students' perceptions of their experiences and the successes and failures they attribute to Tech Prep.* The primary questions related to this objective are: How do students experience the transition from high school to college and/or work? What factors do students identify as contributing to their decisions about continuing to college and/or work? Do they identify Tech Prep as a contributing factor in any way? What significant events have occurred during students' transition processes, and how do they make sense of these events? What improvements can be made in Tech Prep as a result of our gaining insights into their transition experiences?

METHODS

In January 1998 a mixed-method research study was undertaken to better understand Tech Prep implementation and student outcomes in eight purposively selected local consortia in the United States. Prior to the official start of the project, a panel of national experts identified six consortia as mature implementers of Tech Prep in the fall of 1997, and these consortia became the initial sites for the study. Two additional consortia were selected in 1998 at the request of USDE, OVAE, with field visits and additional data collection conducted in early 1999. Criteria used to select all eight consortia for the study were:

- The consortium showed a strong commitment to Tech Prep as a primary vehicle of educational change (though the exact model and approaches varied across the selected sites);
- The consortium was identified by state agency personnel and peer institutions as indicative of the preferred policies, goals, and strategies for Tech Prep implementation within the state;
- The consortium was a "mature" implementer of Tech Prep in that it had started planning and implementation soon after Perkins II funds were awarded (or before) and enrolled students at the secondary and postsecondary levels by the mid- to late-1990s. Also in the mid- to late-1990s, a STWOA-funded initiative had begun, and this initiative had evolved simultaneously with Tech Prep;
- The consortium had initiated local evaluation of Tech Prep, had begun to document student outcomes (often with state support), and was willing to incorporate key aspects of the proposed research design into future plans for local evaluation;
- The consortium was not too unique or extreme to offer potentially valuable lessons about Tech Prep implementation to other consortia;
- The consortium was committed to participate in the study as one means of encouraging local stakeholders to increase their understanding of Tech Prep implementation, to share what they had learned with others, and to use results to improve local programs; and
- Across the consortia selected for this study, there was representation from rural, suburban and urban schools, often within a single consortium. As a result, a diversity of resources and circumstances were evident within and across the consortia studied.

Listed below and shown in Table 2 are the eight selected local Tech Prep consortia, according to their geographic representation:

- The East Central Illinois Education-To-Careers Partnership in Danville, Illinois (referred to as East Central or IL)
- The Metro Consortium[1] (referred to as Met or Metro)

[1] A pseudonym is used to protect the identity of this consortium, in concert with the research protocol agreed upon by UIUC researchers and local officials.

- The Hillsborough Tech Prep Consortium in Hillsborough County and Tampa, Florida (referred to as Hillsborough or FL)
- The Golden Crescent School-To-Careers/Tech Prep Consortium in Victoria, Texas (referred to as Golden Crescent or TX)
- The Miami Valley Tech Prep Consortium in Dayton, Ohio (referred to as Miami Valley or OH)
- The Mt. Hood Educational Partnership in Mt. Hood, Oregon (referred to as Mt. Hood or OR)
- The Guilford Tech Prep Consortium in Guilford County and Greensboro, North Carolina (referred to as Guilford or NC)
- The San Mateo Tech Prep Consortium in San Mateo County, California (referred to as San Mateo or CA)

Table 2
Consortium Settings

Setting	IL	Met	FL	TX	OH	OR	NC	CA
Rural	X		l	X	l		l	
Urban	l	X	X		X	l	X	X
Suburban			X	l	l	X	X	X

Note: **X** = predominant setting, l = some representation

Research Design

The mixed-method design employed by the research team included repeated field visits involving short and long interviews with key stakeholders, a follow-up survey of Tech Prep and non-Tech Prep participants conducted on a consortium-by-consortium basis between summer 1998 and winter 1999, and analysis of high school and community college transcripts. Over more than a two-year period, over 300 interviews were conducted with purposively selected teachers, counselors, parents, and employers representing 62 high schools, 6 area vocational centers, and 10 two- and four-year colleges. More than 150 interviews of 30- to 60-minute duration were conducted with Tech Prep and non-Tech Prep participants in a one-on-one or small-group format usually involving two to four individuals. Most of students were selected purposively because of their participation in Tech Prep; however, some students were chosen at random to provide an understanding of how Tech Prep was perceived among students in the general population. (Table 3 shows the institutional and student composition of each consortium included in the study.)

Table 3
Population and Sample of Institutions and Students by Consortium

Population/Sample	IL	Met	FL	TX	OH	OR	TX	CA	Total
Number of High Schools	12	15	18	19	64	7	14	19	168
(Number sampled)	(10)	(2)	(15)	(18)	(3)	(3)	(6)	(5)	(62)
Number of Secondary Area Vocational Centers	1	0	3	1	2	0	1	0	8
(Number sampled)	(1)	(0)	(1)	(1)	-	-	(1)	-	(4)
Number of Two-Year or Four-Year Colleges	1	1	2	1	1	1	1	3	11
(Number sampled)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(3)	(10)
Total Grads in Sample High Schools	1,805	UK	17,614	2,763	UK	2,902	3,184	4,482	32,750
(Years studied))	(96 - 97)	(95 - 97)	(95 - 97)	(95 - 97)	(96 - 97)	(95 - 97)	(96 - 98)	(95 - 97)	
Tech Prep Graduates in Sample High Schools	370	UK	1,839	954	UK	530	408	313	4,414
(Percent of total HS grads)	(20%)		(10%)	(34%)		(18%)	(13%)	(7%)	(13%)
Total HS Grad. Sample									
Tech Prep HS Grad. Sample, including TP/YAs	551	626	597	586	348	518	724	622	4,572
(TP HS grad. sample as % of Tech Prep HS grads)	293 (79%)	310 (UK)	301 (16%)	295 (31%)	192 (UK)	259 (49%)	408 (100%)	313 (100%)	2,371

***Note*:** Unknown (UK) designates consortia uncertain of the size of the overall school and Tech Prep enrollment. Even though exact estimates were not provided, local officials believed the Tech Prep sample was an accurate representation of the entire population of Tech Prep participants.

The Student Sample

Within each consortium, a sample of Tech Prep and non-Tech Prep participants was selected to provide the basis for the analysis of student outcomes. Local definitions, given in latter sections, dictated the selection of Tech Prep participants to ensure that this research was sensitive to different conceptualizations of the Tech Prep concept in each consortium. [Readers are again

refereed to the complete preliminary report (Bragg et al., 1999) that provides detailed information about each consortium's policies and practices pertaining to Tech Prep implementation, including definitions.) In total, almost 4,600 students were selected for the follow-up study across all eight consortia from the 1995, 1996, and 1997 high school graduating classes, with roughly equivalent numbers of Tech Prep and non-Tech Prep participants in each group (or panel). (Refer to Table 3 again for student population and sample sizes for each consortium). Depending upon the population, Tech Prep participants were selected in proportion to their representation in the 1995, 1996, and 1997 high school graduation classes. Since Tech Prep grew in most consortia over this time period, the sample tends to be more heavily weighted toward 1996 and 1997 high school graduates, with some consortia combining the 1995 and 1996 groups consortia or eliminating the 1995 group altogether because of low numbers. One consortium, the Guilford consortium, added a 1998 graduate group because no Tech Prep high-school graduates existed in 1996, and local leaders wanted the opportunity to track three panels so added the 1998 group.

A systematic random sampling procedure was employed to ensure that the two groups of students would be similar based on high school academic performance as measured by cumulative grade point average (GPA) and/or class rank percentile (CRP) at the time of high school graduation. By controlling for academic performance, we attempted to enhance comparison of the two groups on dependent measures associated with post-high school educational and employment outcomes. We acknowledge, however, that this decision limited our ability to assess the impact of Tech Prep on secondary-level outcomes, such as high school dropout, graduation and academic attainment, since variation on these outcome measures was minimized intentionally.

Recognizing this important limitation, we argue that since our primary interest was not on secondary education outcomes but on outcomes that students would achieve after high school (consistent with the transition-oriented 2+2 curriculum), we preferred to minimize initial differences between the two groups on key variables (such as high-school academic performance) to maximize our ability to discern the impact of Tech Prep on post-high school outcomes. Indeed, the chosen design did prove useful in controlling for individual differences due to academic performance during high school, a known predictor of college attendance and completion (see, for example, Pascarella & Terrenzini, 1991).

Data Sources and Data Analysis

During the summer and fall of 1998 high school transcripts were acquired for 98 percent of the sample, and nearly 2,000 transcripts were obtained for all students who matriculated to the main postsecondary institution (usually a community college except in one case), constituting about 40 percent of the entire sample. The response rate for the follow-up survey was approximately 50 percent overall, ranging from 38 percent in two consortia to 62 percent in another, with others showing a response rate of about 45 percent. For details on the data collection methods and instrumentation, readers are referred to the original *Tech Prep Implementation: Preliminary Student Outcomes* report.

Analysis of the qualitative data involved descriptive and inferential statistics, first examining the frequency with which particular phenomenon are occurring independently and in conjunction with other phenomenon, utilizing measures of central tendency, frequency distributions, and

cross-tabulation tables. Relationships between variables were examined with various correlation coefficients and Chi Square statistics deemed appropriate for the data. In terms of qualitative data analysis, document analysis was conducted utilizing local consortium artifacts (e.g., final reports, curriculum guides, brochures, strategic plans) with qualitative procedures articulated by Lincoln and Guba (1985) and Patton (1990) guiding our analysis decisions.

Based also on guidance of the literature, most of our interviews were tape recorded and later transcribed, but sometimes only handwritten notes were taken to maximize trust between interviewer and interviewee. Triangulation was employed by examining multiple data sources and multiple informant perspectives, maximizing our confidence in the trustworthiness of the results (Lincoln & Guba, 1985). We also conducted member checking after each field visit, asking local participants to review our notes and comment on their clarity and accuracy. After the first phase of the study in 1998-99, we traveled back to each site to conduct a de-briefing session designed to present preliminary results. These return meetings were valuable in terms of enhancing the validity of the findings, but also in discussing the utility of the results for local consortia involved in making program improvements and demonstrating accountability.

Limitations

A recognized limitation of the study is the low response rate obtained to the student follow-up survey in several consortia studied. Recognizing that this matter places a serious limitation on generalizability beyond consortium boundaries, let alone within the local region, we believe this limitation is off-set to some extent by the exceptionally high response to our collection of transcripts by the participating secondary schools and colleges. Also, the strong sense of commitment and cooperation shown by individuals engaged in our field work provided access to information far beyond our expectations, thereby enhancing our understanding of implementation as it relates to student participation and outcomes.

CROSS-CONSORTIUM FINDINGS

The primary intent of this study was to provide a detailed description of the evolution of Tech Prep implementation in eight local consortia and a better understanding of the emerging relationships between the implementation of key components and students' educational experiences and outcomes. The study looks specifically at students' Tech Prep experiences as they relate to transition from the secondary to postsecondary level of education and/or work. Results presented herein pertain to local grants and administration as well as the essential elements of Tech Prep, as specified in the federal Perkins III (1998) legislation (shown previously in Table 1). This section provides a brief description of results related to local consortium goals and administration, the essential elements, and student participation and preliminary outcomes.

Consortium Administration, Goals and Strategies

The fundamental goal of all eight local consortia centered on preparing students to enter a technology-based workforce through their participation in a 2+2 integrated academic and career-technical education (CTE) program. Whereas this overarching goal was pervasive, the implementation of it took on various forms. In consortia that sought to apply the mandate of a higher-level entity (usually a state department or board of education governing K-12 education), local implementation often centered on internal issues more than on external concerns generated by business and industry, universities, or other organizations viewed as peripheral. Perspectives of these external entities were not overlooked entirely, but they were not raised to as high a priority as educational issues viewed as most critical to reforming the system. In these cases, changes precipitated by Tech Prep also centered mostly on secondary education more than on the postsecondary level.

The formal leaders of local Tech Prep consortia, referred to as coordinators or directors, were central to leading changes at the secondary level, even when the consortium was headquartered within a postsecondary institution, usually a community college. Beyond the local Tech Prep coordinator, many of the goals and objectives stressed as pivotal to Tech Prep seemed unclear to other local practitioners. This uncertainty of purpose and lack of clarity of scope and intent could help to explain, at least in part, why the target population of students shifted from Tech Prep for the neglected majority (Parnell, 1985) to all students, especially after the School-to-Work Opportunities (STWO) legislation was enacted. Confusion among practitioners about the purpose of Tech Prep was also evident as consortium leaders increasingly linked Tech Prep to enhance students' academic course-taking and raise academic standards endorsed by state agencies increasingly over the decade of the 1990s.

Tech Prep leaders faced many challenges in attempting to raise academic expectations, including for students thought to be non-college bound. Consortia that had designed programs emphasizing workforce development and technical employment sometimes had difficulty reasserting their mission on enhancing academic performance. Local leaders who had focused Tech Prep on the neglected majority student population questioned how best to enable these students to meet increasingly higher standards when they remained committed to delivering programs addressing technical preparation, often including WBL. With limited scheduling options in high schools, leaders were perplexed about how to conceptualize Tech Prep in ways that would deliver advanced (and also integrated) academic and CTE course work. To make such

a dramatic change, policies had to be modified in local systems and these decisions usually went well beyond the authority of Tech Prep leaders. Even with the best political savvy, Tech Prep advocates could not change policies outside of their span of control. For many educators working diligently to implement Tech Prep, this dilemma presented serious frustration. Moreover, having seen the purpose of Tech Prep shift throughout the 1990s, they looked to the future and wondered whether goals considered paramount today would be as important tomorrow.

Two important changes emerged over time that facilitated Tech Prep implementation in several consortia. First, in the majority of consortia block scheduling was implemented in at least a few high schools, and Tech Prep was viewed as contributing to this change. In order to create sufficient time blocks for joint planning time, integrated academic and career/technical (CT) instruction, and work-based learning (WBL) experiences for students and teachers, block scheduling increasingly made sense to school officials. Through concerted efforts requiring the re-education of school personnel, board members, students, parents, and sometimes the community at large, block scheduling was adopted in selected schools in nearly all the consortia involved in this study. When this was done, Tech Prep leaders and school administrators began to see more opportunities open up to implement the essential elements of Tech Prep.

A second change that helped to establish Tech Prep as a more academically-oriented, college-prep vehicle was scholarships. Several consortia experienced success with Tech Prep by enticing students through college scholarships. Usually developed with local college foundation and/or business funds (with Florida's Gold Seal Scholarship program being a noteworthy exception because of its state-level support), the presence of scholarships served as a powerful incentive to encourage students to participate in Tech Prep. In consortia offering the most extensive scholarship opportunities, students in the Miami Valley and Hillsborough were very enthusiastic about the financial support Tech Prep scholarships provided them. These students readily attributed scholarships to solidifying their commitment to Tech Prep, including the decision to transition to the postsecondary level. Scholarships offered by the East Central, Guilford and Golden Crescent consortia were tied to particular CTE programs. These financial awards were influential in encouraging students to get into Tech Prep in high school and transition on in the program at the community college.

Over time, governance and administrative frameworks changed incrementally to accommodate the expansion of Tech Prep. In some consortia, administrative policies and organizational structures were already in place for Tech Prep via the existing vocational education system. This structure provided a convenient home for Tech Prep, attempting to support its evolution but also sometimes constraining it. Traditional approaches to administration, curriculum, and instruction could enhance but also impede the adoption of changes endorsed by Tech Prep leaders. Trouble with implementation was sometimes evident when Tech Prep was tied too closely to terminal vocational education programs and therefore seen as an extension of prior tracking mechanisms firmly entrenched within high schools. Because of this concern, most consortia chose to implement broad-based approaches to Tech Prep that could involve nearly all students in some way, through enhanced career guidance, contextual instruction, WBL, or other strategies.

Another important structural feature involved locating the Tech Prep consortium office at the postsecondary level. Similar to the relationships between Tech Prep and vocational education,

locating the main consortium office at the college-level had advantages and disadvantages. When housed at the community college, Tech Prep leaders sometimes had minimal influence over secondary school finances, personnel, and other related policies they perceived as needing change. Consortium offices located at the college level also usually operated separate from regional vocational systems, sometimes creating tensions over funding and administrative authority. Partly to enhance their credibility, Tech Prep leaders often organized a mélange of in-school Tech Prep supporters and a broader cadre of educational leaders (local and state), board members, and business representatives whose purpose was to legitimize and energize local implementation efforts. In so doing, Tech Prep leaders could generate the critical mass needed to move Tech Prep ahead, even when controversial matters could slow or halt progress altogether.

With respect to School-to-Work (STW), the consortium structures started with Tech Prep sometimes provided the underpinnings for newer STW partnerships. Such was the case in at least half of the consortia under investigation here. Some divergent goals are evident between Tech Prep and STW, yet in most consortia local leaders coordinated their efforts. In fact, in some communities the two initiatives were merged into one entity with the leadership of Tech Prep and STW being one and the same. Consortia operating TP/Youth Apprentice (YA) programs provided a good example of how fully integrated Tech Prep and STW could become. With TP/YA, the school-based learning (SBL) component that originated with Tech Prep was blended with the WBL encouraged by STW. A high level of integration was a positive sign that the limited resources associated with both reforms could be coordinated to create a more systemic approach. Even so, in regions where Tech Prep and STW were integrated extensively, local leaders worried about how similar or distinctive the two initiatives should be, given the cloudy future for STW. In two communities included in this study, a visible lack of cooperation and tension emerged because of poor communication and duplication of effort. Recent interviews conducted in these sites revealed that when STW funding ceased, Tech Prep continued several important initiatives funded by STW but other remnants of STW faded.

To a significant extent the ongoing expansion of Tech Prep (and usually STW) reflected the success of local leaders at eliciting business participation in the local implementation process. In fact employers were highly visible in the majority of consortia studied. For example, the involvement of the Guilford, North Carolina consortium in Tech Prep and later STW was precipitated by business and industry's plea to improve K-12 education. A similar scenario evolved in Danville, Illinois, another community that launched youth apprenticeship programs along with Tech Prep. Building Tech Prep and later STW through a partnership between business and education resulted in the evolution of a governance structure over time in both of these settings, first through chambers of commerce and later through industry councils.

The Essential Elements

This section addresses major results associated with each of the legislated "essential elements" of Tech Prep as revealed through the field research involving short and long interviews, document analysis, and classroom observations.

Articulation Agreements

Articulation agreements provided the foundation for curriculum reform associated with Tech Prep throughout the 1990s, especially in the beginning. Still, consortia struggled to entice students to access the articulated credits they accumulated in high school. The lack of usage of articulated courses by students seemed to happen for several reasons. First, students were often unaware that they had accumulated college credits, sometimes showing surprise when we told them classes they took in high school would qualify them for college credit. In other cases, students knew about the college credits, but indicated that their secondary teachers and/or college instructors had discouraged them from skipping the class once they got to college. They were told that taking the class, if only as a refresher, would provide better preparation than omitting the class from their college studies altogether. In a few cases we talked to students who had made this decision on their own, indicating their teachers had advised them to get the articulated credit. Still, they declined, believing that repeating the course would better prepare them for more advanced classes. These students seemed to lack confidence that their high school classes had provided sufficient depth and rigor to prepare them for college-level course work.

Moreover, mechanisms for monitoring articulated credits among college entrants were not fully developed in any of the consortia studied, though some colleges were more sophisticated at collecting information relevant to the articulation process than others. Though not the only reason, issues surrounding articulated credits and monitoring their usage had prompted a recent trend among the consortia to offer dual credits. With dual credits, students would receive college credit at the time a course was completed in high school rather than after college enrollment and sometimes after a required semester or two lag time. By awarding the credit more immediately, consortium leaders were attempting to streamline the articulation process and make articulation a tangible reward for student participation.

Our interviews also revealed that when students linked articulated credit to time-savings they were even more interested than when monetary savings were emphasized, probably because of the low tuition associated with community college attendance. To enhance articulation even more, most consortia were making deliberate plans to implement dual credit in association with academic courses taken during high school as a part of the core Tech Prep curriculum. Since CTE courses had been emphasized with Tech Prep before, attention was shifting to academic courses in more recent times.

Even with its challenges, the articulation process has yielded some intended and untended benefits. For example, through articulation processes educators from the secondary and postsecondary levels have communicated about content and standards for curriculum. As a result, they have created new sequences of career-technical (CT) and academic courses, providing a logical curricular progression from the secondary to postsecondary level. Also, the articulation process has facilitated a more continuous review of courses and the adaptation of existing content to new academic and occupational standards, usually at the state level but also

sometimes locally. As such, some schools have used Tech Prep to address statewide curriculum standards and assessment efforts, an issue mentioned later in this report.

2+2 Curriculum

In terms of 2+2 core curriculum, consortia were split evenly as to whether they started Tech Prep curricula in grade 9 or grade 11. All but one consortium indicated some availability of curriculum involving four-year colleges so that students would not complete Tech Prep at the Associate-degree level only. However, when consortia offered the latter two years at the four-year level, it was usually limited to a particular CTE specialization, such as engineering technologies, nursing, or business. Two of the consortia also linked Tech Prep to adult apprenticeship opportunities. Though sometimes not recognized as a legitimate approach because it is supposed to result in at least the two-year degree, several consortia associated Tech Prep with postsecondary certificates, viewing them as a stepping stone to Associate-degree attainment. (See Table 4 for a description of the basic core curriculum models used by each consortium.)

Table 4

Core Curriculum Models Utilized by Consortium

Models	IL	Met	FL	TX	OH	OR	TX	CA
2+2		X			X	X		X
2+2+2		l			l	l		
4+2	X		X	X			X	
4+2+2	l		l	l			l	

Note: X = primary articulation model, l = some representation of this model

When summarizing national evaluation results, Hershey et al. (1998) characterized Tech Prep programs that exist in the field as having one of three forms. The first form of Tech Prep is labeled "structured, comprehensive programs of study" (p. 79). These programs are designed to provide students with a sequence of integrated CT and academic courses in high school that have a broad career focus but lead to a more specialized program or set of programs at the postsecondary level. Students participating in this form of Tech Prep typically go through an application and selection process and are grouped together into a cohort group, once admitted. This form of Tech Prep can pervade the entire school curriculum or it can be highly focused on a small group of students that is viewed as capable but lacking in motivation to participate in the traditional college prep curriculum. Youth apprenticeship and career academy programs typify this idea of Tech Prep.

As is noted in Table 5, in the eight consortia engaged in this study, this model was most evident in three. In the East Central and Guilford Consortia the Tech Prep/youth apprenticeship (TP/YAs) approach was well developed. In another consortium, the Miami Valley Consortium, the structured, comprehensive model was also evident, and this form of Tech Prep predominated all identified Tech Prep programs there.

A second form of Tech Prep mentioned by Hershey et al. (1998) is referred to as the "enhanced vocational program" (p. 83). With this approach, CTE programs provide the foundation for Tech Prep by targeting students who have traditionally participated in career-focused curriculum and encouraging them to take applied academics courses and/or other appropriate academic courses to complete a specified core curriculum. With this approach, students are not grouped into special classes or panels, but rather counseled into courses that are open to all students who meet the high-school Tech-Prep curricular requirements as preparation for the postsecondary level. Across the eight consortia, this form of Tech Prep was the most evident, although most of the consortia were expanding the target population beyond CTE students to be more inclusive of all students. Four consortia demonstrated extensive use of this form of Tech Prep through an array of Tech Prep programs, and one consortium used this form of Tech Prep as a means of attracting the general student population to participate in Tech Prep while it also offered the structured, comprehensive form of Tech Prep for students participating in more selective TP/YA (work-based Tech Prep) programs.

Table 5

Tech Prep Models Utilized by Consortium

Models	IL	Met	FL	TX	OH	OR	NC	CA
Structured, comprehensive Tech Prep	X				X		X	
Vocational Tech Prep	X		X	X		X		X
Non-Targeted Tech Prep	--	--	--	--	--	--	--	--
Work-based Tech Prep	X						X	
Integrated Tech Prep		X						
College Tech Prep			1	1			X	

Note: X = primary articulation model, 1 = some representation of this model

The third form of Tech Prep mentioned by Hershey et al. (1998) is the "non-targeted" approach (p. 88). According to Hershey et al., the non-targeted form of Tech Prep is associated with an untargeted approach to student identification coupled with an untargeted offering of educational reform strategies, such as applied academics, career guidance, and articulation agreements. Whereas several consortia had moved toward offering a wider array of Tech Prep programs and activities for more students, sometimes all students, we did not believe the "non-targeted" characterization of Tech Prep accurately fit what was happening in any of these sites. Encouraging more students to take part in Tech Prep by rejecting tracking or special grouping arrangements, as several of these consortia had done, is not synonymous with having "no target population" (Hershey et al., 1998, p. 88). Therefore, since the consortia were deliberate in their decision making about Tech Prep and strategic about implementation of essential elements, we did not attribute the "non-targeted" model to any of the consortia studied.

Two models described by Bragg (1995) as the work-based Tech Prep and the integrated Tech Prep characterized other approaches to Tech Prep utilized by these consortia. With respect to the work-based Tech Prep model, two consortia offering TP/YA programs (East Central and Guilford) clearly typified this approach in that students' learning was "deliberately organized...to link learning in the workplace with students' school- and college-based learning experiences" (p. 202). One consortium demonstrated features of the integrated Tech Prep model more than any other described by Hershey et al. (1998). In the Metro Consortium, Tech Prep emphasizes integrated academic and CT curriculum around career clusters (or Tech Prep pathways) that began in high school and ended at the two- or four-year college level. Off-the-shelf curriculum packages were not emphasized as much as unique integrated concepts developed and delivered by teams of instructors, sometimes from both the secondary and postsecondary levels.

The last model exemplified by the selected consortia was the College Tech Prep model, and this approach is based heavily on the traditional College Tech Prep curriculum with CTE curriculum emphasized for elective courses. Instead of linking Tech Prep to the general education curriculum, consortia engaged in College Tech Prep emphasize academics that meet four-year college and university requirements in their state. Consortia utilizing this model usually do not gear College Tech Prep toward the most selective university, but rather second-tier universities where the vast majority of students matriculate. In so doing, College Tech Prep offers heightened opportunities for college, ensuring students are ready for almost any four-year and all two-year colleges in the state. The Guilford consortium offered the most extensive implementation of this approach, encouraging all Tech Prep students to take the "College Tech Prep" route. Two other consortia made the College Tech Prep option available, and our study showed that some but not all Tech Prep participants took advantage of it.

Curriculum Development

As the decade of the 1990s proceeded, an important goal of Tech Prep, according to federal legislation, was to become a legitimate part of the broader educational reform agenda and linked to raised academic standards. Still, in most consortia Tech Prep programs did not state explicitly that course work beyond the minimum high school graduation requirement was necessary for Tech Prep participants. A conspicuous exception was the College Tech Prep model and the selective Tech Prep/youth apprenticeship programs. Table 6 provides details on the general high school graduation requirements for each consortium. Only three consortia list practical arts,

professional-technical, vocational or CT courses as required; other consortia did not specify any form of CTE course work as part of high school graduation requirements at all.

Table 6
Minimum High School Graduation Requirements by Consortium

Sites	English	Math	Science	Social Studies	Electives	Total Credits/ Units Required
IL	3-4 years*	2 years	1-2 years*	1-2 years*	1-2 years* (Music, Art, or Foreign Language)	19-24*
Met	4 units	3 units	3 units	4 credits	1.5 – 3.5 units**	20
FL	4 credits	3 credits	3 credits	3 credits	8.5 credits .5 credit health .5 credit fine or practical arts	24
TX	4 credits	3 credits	2 credits	2.5 credits	.5 credit economics .5 credit health	22-27*
OH	3 units	2 units	1 unit	2 units	.5 credit health	18
OR	4 years	2 years	2 years	2-3 years*	9 credits applied arts, fine arts, foreign language, and professional-technical education	24-29*
NC	4 courses	3 courses	3 courses	3 courses	1 credit health/PE 5-8 elective credits** 4 sequential technical courses required for College Tech Prep students	22
CA	3.5-4 years*	2 years	2 years	3 years	1-2 years in a foreign language* 1 semester health 55-60 credits (1 semester course equals 5 credits)	22

***Note*:** Different states use different language to express high school graduation requirements. For the purposes of this analysis, years, credits, units, and courses are standardized and treated as equivalent. * indicates the requirement varies for high schools within a consortium, ** depends on the program of study (i.e., College Prep, College Tech Prep, University, State Scholars)

An examination of the high school graduation requirements, particularly in mathematics, provides a clearer understanding of the rigor of the curriculum requirements across the eight consortia. Results shown in Table 7 indicate wide variation in the starting point for math course-taking for Tech Prep participants, ranging from at least 65 percent starting below Algebra I in East Central, Hillsborough, Miami Valley, and Mt. Hood to 20 to 40 percent in the Golden Crescent and Guilford consortia. In one-half of the consortia non-Tech Prep participants started at a higher level in the high school math curriculum than Tech Prep participants. Also, in most consortia a small percentage of Tech Prep and non-Tech Prep participants were identified as taking applied math courses; in one consortium an integrated math curriculum was provided for all students but local Tech Prep leaders refused to consider this course, expressing concern about the quality of applied academics courses and refusing to associate applied academics with Tech Prep.

Table 7
Percentage of Students by Starting Point for High School Math by Consortium

Sites	Percent Students Starting Below Algebra I			Percent Students Starting With Algebra I or Higher			Percent Tech Prep Students with Applied Math
	TP	NTP	YA	TP	NTP	YA	TP only
IL	66%	58%	66%	34%	42%	34%	19%
Met	48%	66%	--	52%	34%	--	--
FL	70%	48%	--	30%	52%	--	34%
TX	21%	25%	--	79%	75%	--	9%
OH	86%	36%	--	15%	64%	--	45%
OR	68%	54%	--	32%	46%	--	15%
NC	37%	41%	39%	63%	59%	62%	22%
CA	48%	53%	--	52%	47%	--	4%

Note: Percentages do not add to 100% for the Tech Prep (TP), non-Tech Prep (NTP), and Youth Apprentice (YA) groups due to rounding.

To determine the extent of academic course-taking, preliminary analysis also examined whether Tech Prep and non-Tech Prep participants had completed Algebra I and also Algebra II or above. Results shown in Table 8 suggest that the vast majority of Tech Prep and non-Tech Prep participants completed Algebra I, with over 90% in 6 of 8 consortia. Results for Algebra II

or above course-taking showed a different pattern. Overall, the percentage of students completing Algebra II or above ranged from a low of 23 percent in the Mt. Hood consortium to a high of 90 percent in the Guilford consortium, a site emphasizing the College Tech Prep model. Also, in five of the eight consortia there were discernable differences between the Tech Prep and non-Tech Prep groups, with two consortia showing a higher percentage of Tech Prep participants completing Algebra II and above than the non-Tech Prep group.

Results showing advanced math course-taking are important because, as is pointed out in recent analysis by Adelman (1999) on the impact of high school math on baccalaureate attainment, completion of higher-level math courses can be a powerful predictor of college readiness, persistence and completion. Controlling for socioeconomic status (SES), Adelman has shown that advancing on the "math ladder" (1999, p. 16) makes a difference in how far students get in college and on their ultimate success in completing. Acting as a proxy for overall academic preparation, these results suggest differences in math requirements across the consortia independent of Tech Prep but also in association with it. They also suggest differences in actual math course-taking, again both independent from and in association with Tech Prep participation. Future analysis needs to look closely at these course-taking patterns to determine their effect on educational outcomes after students transition to college.

Table 8
Percentage of Students Completing Algebra II or Above by Consortium

Sites	Percent Completing Algebra I			Percent Completing Algebra II & Above		
	TP	NTP	YA	TP	NTP	YA
IL	80%	85%	89%	44%	53%	43%
Met	100%	100%	--	57%	42%	--
FL	94%	98%	--	54%	87%	--
TX	99%	97%	--	69%	65%	--
OH	95%	97%	--	60%	65%	--
OR	87%	86%	--	23%	38%	--
NC	99%	92%	100%	90%	78%	87%
CA	92%	74%	--	66%	65%	--

Note: Percentages do not add to 100% for the Tech Prep (TP), non-Tech Prep (NTP), and Youth Apprentice (YA) groups since Algebra I and Algebra II course-taking are not independent.

Most consortia also offered an increasing array of technology-based programs that attracted students who might not have participated in traditional CTE courses. Career pathways were implemented in all of the consortia in the mid- to late-1990s, and these pathways precipitated new options leading to college. In some sites such as the Mt. Hood consortium, the adoption of career pathways was facilitated by earlier state reform efforts. In other sites, consortia preceded the initiation of pathways or incorporated them later along with state-level adoption of the OVAE, USDE initiative on Building Linkages.

Table 9
Tech Prep (Career) Pathways Associated with Tech Prep by Consortium

Pathway	IL	Met	FL	TX	OH	OR	NC	CA
Arts, communication, and media	X			X		X		
Business and management systems/technologies	X		X	X	X	X	X	X
Health and health sciences technologies		X	X	X		X	X	X
Human and public service technologies	X		X	X		X	X	X
Industrial and engineering technologies	X	X	X	X	X	X	X	X
Transportation systems technologies							X	
Agriculture, natural resources, and agribusiness technologies	X		X			X		
Automotive technologies					X	X	X	
Construction technologies	X		X				X	
Computer technologies	X		X	X	X	X	X	X
Fashion/interior design			X					X

Training for Teachers and Counselors

Professional development has proved to be an increasingly prominent component of Tech Prep in the eight consortia; however, the impact of professional development activities on Tech Prep implementation and student outcomes is difficult to determine, except in anecdotal ways. Beyond the scope of this research, this aspect of Tech Prep requires more careful analysis. Additional research and evaluation examining how teacher and counselor in-service influences Tech Prep implementation and ultimately student outcomes is needed.

With respect to this study, we were able to capture descriptive findings related to teacher and counselor in-service. Over the past ten years, the number and type of professional development opportunities increased in all consortia, along with the number and type of constituents (and organizations) participating. In most cases a limited number of personnel were engaged in professional development, and these were mostly secondary CTE teachers. However, in recent years several hundred personnel engaged in professional development on a regular basis in many of the consortia. (For example, the Miami Valley consortium involved more than 400 teachers, counselors, and business representatives in professional development during the 1998-99 school year.)

In all sites, participants in professional in-service included a much more diverse group of participants than in earlier days, including academic and CTE teachers and counselors across the secondary and postsecondary levels. Parents, business and industry representatives, community leaders, and sometimes students were involved. Over time, as Tech Prep shifted from the awareness and planning stages to full-scale implementation, professional development was used to encourage and support its evolution. First, it was used to help sell and inform people about Tech Prep. Later it was used to provide necessary information to develop core curriculum and provide integrated and applied academics instruction. Still later professional development emphasized career pathways, contextual learning, and WBL.

Local business and industry has played an important role in teacher and counselor in-service for Tech Prep, according to personnel in some consortia. A specific example of how businesses have supported professional development includes how several consortia began expanded training for teachers in business and industry, especially in the provision of training for teachers and counselors within local business facilities. Teachers and counselors shadow business employees to learn about their jobs and the work environment, sometimes documenting "real world" examples that can be offered to enhance instruction in academic and CT classes. Used extensively in a few consortia, this approach was attributed with having a positive impact on changing faculty attitudes about Tech Prep and then gaining their commitment to the initiative. Professional development involving employers also helped to improve career guidance as more counselors participated in training that provided up-to-date information about careers and the workplace.

Preparatory Services

Across the consortia, preparatory services were conceptualized and implemented in different ways. In some consortia, career exploration and guidance was emphasized, as was the case in the Hillsborough and Golden Crescent consortia, particularly when the STW initiative took hold. The use of Individualized Career Plans (ICPs), career inventories, career exploration, and job

shadowing activities were prevalent among consortia that emphasized preparatory services that revolved around career guidance and counseling. Sometimes STW funds were utilized at the K-8 levels to help younger students prepare to make a smooth transition into high school. Since Tech Prep funds are not allowed at the lower-grade levels, STW was beneficial to Tech Prep when funds were used in this manner.

In a consortium such as the East Central consortium, preparatory services took a different form. In this consortium, preparatory services took the form of mentoring of Tech Prep/youth apprentices by their predecessors who had already matriculated to the community college. Once at the college, faculty continued the mentoring process by supporting college-level Tech Prep/youth apprentice students, particularly with their WBL experiences in business and industry. Tech Prep participants in the Metro consortium performed a similar mentoring role for younger students. More recently, the Metro consortium had initiated "college readiness" classes on Saturdays to help any student but especially Tech Prep students to prepare for college entrance tests and sharpen their study skills for college. These types of classes had also been initiated recently in the Hillsborough and Golden Crescent consortia.

Equal Access for All Learners

Most consortia encouraged enrollment in Tech Prep by all students, but placed its greatest recruitment effort on the neglected majority students. Only a few consortia emphasized specific admission requirements, and these were the TP/YA programs. Besides acting to prepare students for employment, there is little doubt these programs were operating as a screening device for local business and industry. With respect to admission, both the East Central and Guilford consortia involved business and industry in the selection of prospective students for TP/YA programs. One other consortia enforced admission requirements and that was the Miami Valley Consortium. While not known as TP/YA programs, the Tech Prep programs in this consortium had very close ties to business and industry since the consortium had targeted technical occupations in high demand. These programs, too, looked at business and industry for guidance on admission standards. In all cases, it is important to note that the consortia ultimately used what were perceived as modest and reasonable admission requirements, such as a C average in basic math or Algebra I, good attendance, and lack of discipline problems in previous high school days. To reinforce this perception, we interviewed students about the admission requirements and in no cases did we learn that students felt discouraged from participation in Tech Prep because they could not get into the program. In fact, having an admission requirement seemed to add prestige to the programs, if any effect was noted at all.

Student Demographics. One way of understanding access to Tech Prep programs is to examine characteristics of students who have enrolled. Looking at the demographic characteristics of Tech Prep and non-Tech Prep participants, Figure 1 reveals the gender of Tech Prep and non-Tech Prep participants involved in the eight consortia. Except for three consortia, the proportion of female and male participants in Tech Prep is similar. The three consortia having a disproportionate number of males to females are the East Central, Guilford, and Miami Valley consortia. Interestingly, these are the same consortia that have admission requirements for selected Tech Prep programs. Further study is needed to understand the relationships between recruitment, admissions decisions, and student participation in these programs. Anecdotal evidence suggests leaders of these consortia are aware of the potential for bias when selective admission is used, and that they have employed recruitment strategies to increase female and

minority participation. However, questions about equal access are critical ones that deserve serious study. If there are blatant or subtle ways in which admissions policies and practices negatively influence participation by diverse groups, they need to be identified and remedied. To the extent that our data set will allow, we intend to investigate these questions further.

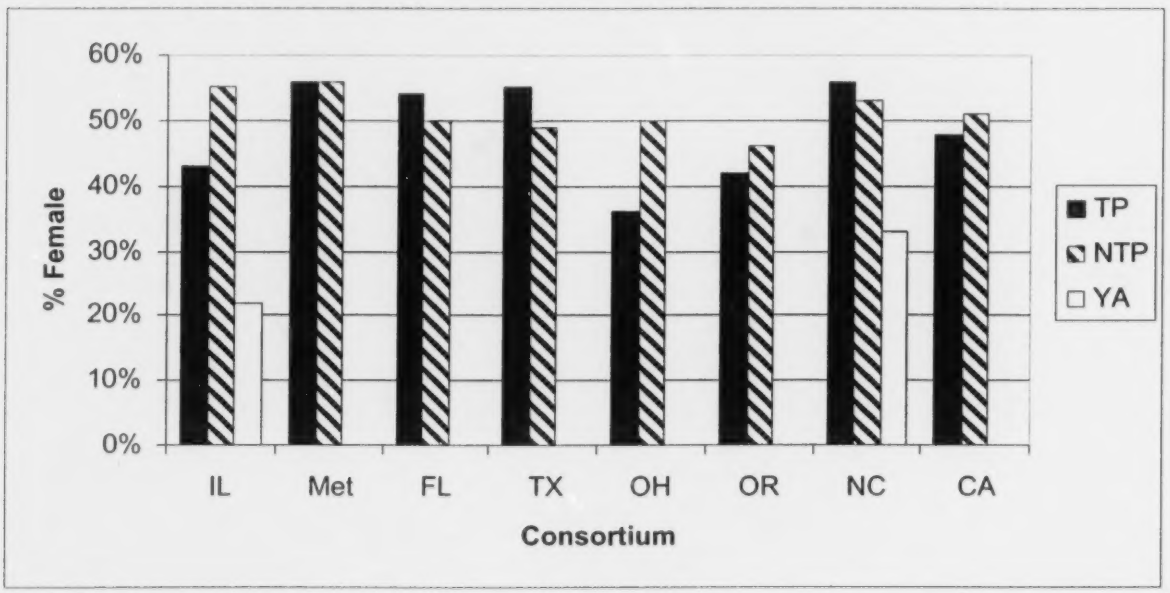

Figure 1. Percentage of Tech Prep, Non-Tech Prep, and TP/YA Participants who are Female by Consortium

Participation by minorities and students reporting total family income below $30,000 while attending high school is shown in Figures 2 and 3. Minority enrollment does not appear to be different for the Tech Prep and non-Tech Prep groups; however, some consortia display much larger minority enrollment than others (i.e., Golden Crescent, Guilford, Hillsborough, Metro, and San Mateo) due to their larger representation in the communities selected for study. Minority enrollment appears to be similar to minority representative in the overall school population, and greater or lesser diversity among Tech Prep participants is reflective of the differences in the demographics of the local communities.

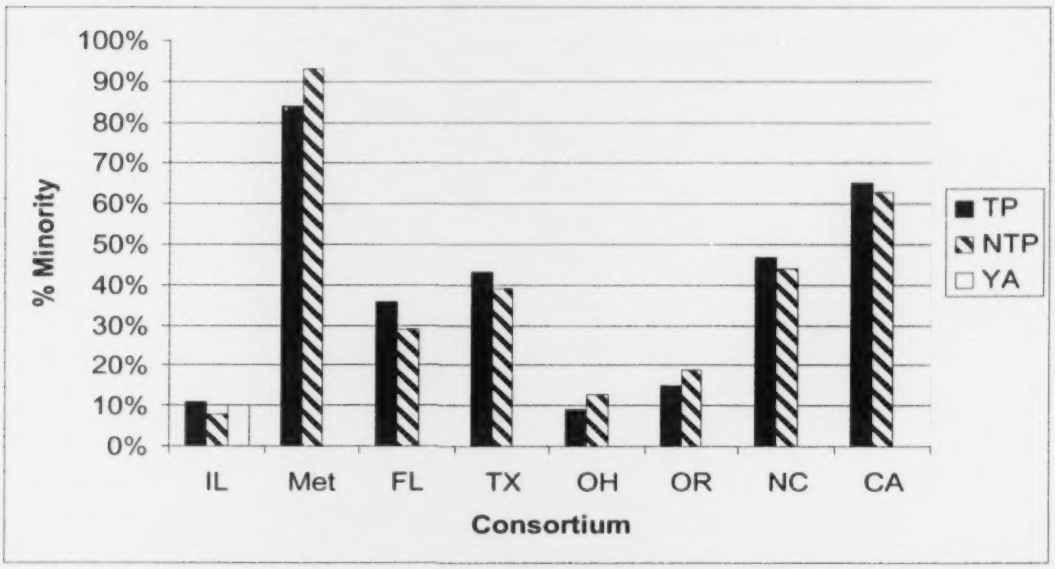

Figure 2. Percentage of Minority Tech Prep, Non-Tech Prep, and TP/YA Participants by Consortium

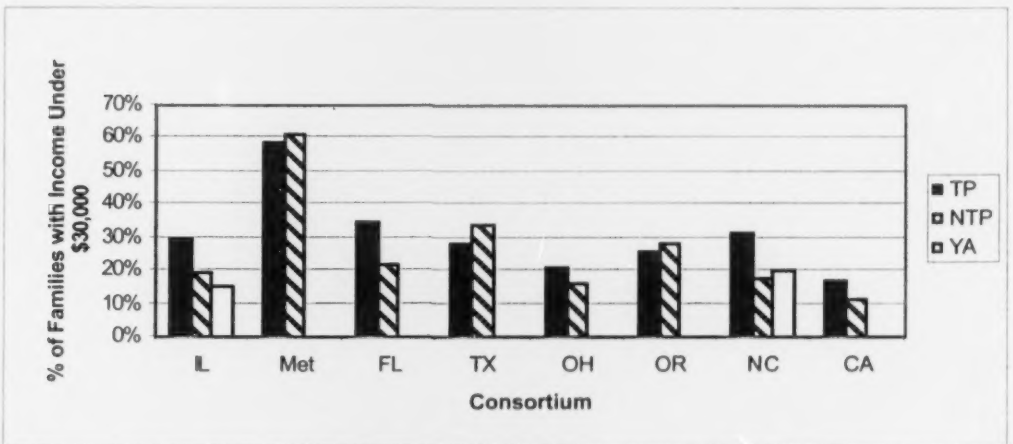

Figure 3. Percentage of Tech Prep, Non-Tech Prep, and TP/YA Participants having Family Income under $30,000 by Consortium

Similarly, Figure 3 shows that family income was comparable for the Tech Prep and non-Tech Prep participant groups in five consortia (i.e., Golden Crescent, Miami Valley, Metro, Mt. Hood, and San Mateo). In the East Central, Guilford, and Hillsborough consortia, Tech Prep participants were more likely to come from lower income families than their non-Tech Prep counterparts. Discussed more fully in the individual cases later in this report, results show the education level of parents is distributed similarly, with Tech Prep participants' parents slightly less likely to have attended college than the non-Tech Prep groups.

Student Participation and Preliminary Outcomes

Since their inception, all of the consortia have experienced an increase in student enrollment in Tech Prep. There are many reasons for enrollment increases, including the fact that Tech Prep implementation was spreading into more CTE areas and information about the programs were being disseminated more widely. Certainly as local initiatives matured over the 1990s they became increasingly capable of accommodating more students because more teachers were trained, more school guidance mechanisms were implemented, more integrated classes were offered, and more students were informed. In consortia providing three years of enrollment data, usually for the 1994-95 through 1996-97 period, secondary enrollment in Tech Prep increased by approximately 250 percent in the Golden Crescent and Hillsborough consortia and 60 to 80 percent in the Mt. Hood, Guilford, and San Mateo consortia. Moreover, Tech Prep enrollment as a percentage of total high school enrollment varied from only 7 percent in the San Mateo consortium to almost 35 percent in the Hillsborough consortium, and an average of 15 percent for the remaining consortia. It is also important to note that a few consortia intentionally kept enrollment low in the overall Tech Prep curriculum and in specific programs, such as the TP/YA programs. For example, less than 4% of the eligible eleventh and twelfth-grade students in the Miami Valley consortium participated in Tech Prep, and this level of enrollment was acceptable to local officials.

Revealing results similar to the previous figures, Table 10 shows a breakdown of the Tech Prep, non-Tech Prep and TP/YA groups on gender, minority status, marital status as single, father's highest education as high school or less, and family income at $30,000 or less. These demographic statistics are reported on a consortium-by-consortium basis to facilitate comparisons by consortium.

Table 10

Percentage of Students by Demographic Characteristics and Consortium

Site	Percent Female			Percent Minority			Percent Single			Percent Father's With High School Diploma or Less			Percent Family Income Under $30,000		
	TP	NTP	YA	TP	NTP	YA	TP	NTP	YA	TP	NTP	YA	TP	NTP	YA
IL	43%	55%	22%	11%	8%	10%	86%	88%	90%	49%	45%	55%	30%	19%	15%
Met	56%	56%	--	84%	93%	--	87%	90%	--	59%	62%	--	59%	61%	--
FL	54%	50%	--	36%	29%	--	85%	93%	--	53%	38%	--	35%	22%	--
TX	55%	49%	--	43%	39%	--	86%	84%	--	49%	47%	--	28%	34%	--
OH	36%	50%	--	9%	13%	--	96%	88%	--	51%	37%	--	21%	16%	--
OR	42%	46%	--	15%	19%	--	85%	81%	--	40%	36%	--	26%	28%	--
NC	56%	53%	33%	47%	44%	43%	92%	94%	83%	51%	41%	41%	31%	18%	20%
CA	48%	51%	--	65%	63%	--	95%	92%	--	30%	21%	--	17%	11%	--

Transition to College

A primary goal of Tech Prep is to assist more students to transition to college having completed rigorous academic and CTE courses in high school. Through the completion of these programs students are expected to gain the skills and knowledge needed to enter the workforce in technical careers. Though our analysis is preliminary on transition to college and we are not yet ready to report on matriculation within particular Tech Prep pathways[2], we can account for transition to two- and four-year college and work overall. Indeed, this study reveals that a high percentage of Tech Prep participants continue on to postsecondary education of some type after high school graduation. Results suggest that, across all eight sites, at least 65 percent of Tech Prep participants enrolled in some form of postsecondary education within one and three years of high school graduation. In fact, the percentage of Tech Prep participants entering college exceeded 75 percent in five of the eight consortia. In all but one consortium a higher percentage

[2] This analysis will be completed when we receive a second set of community college transcripts for each participant in the study.

of Tech Prep participants enrolled in two-year college than their non-Tech Prep peers, though the difference was usually modest. Figure 4 reveals three exceptions in that more Tech Prep participants in Miami Valley, TP/YA participants in East Central, and Tech Prep and TP/YA participants in Guilford went on to two-year college than non-Tech Prep participants. Figure 4 displays the percentage of Tech Prep and non-Tech Prep participants who transitioned to a two-year college only. (Individuals who attended two- and four-year colleges are eliminated from this figure.)

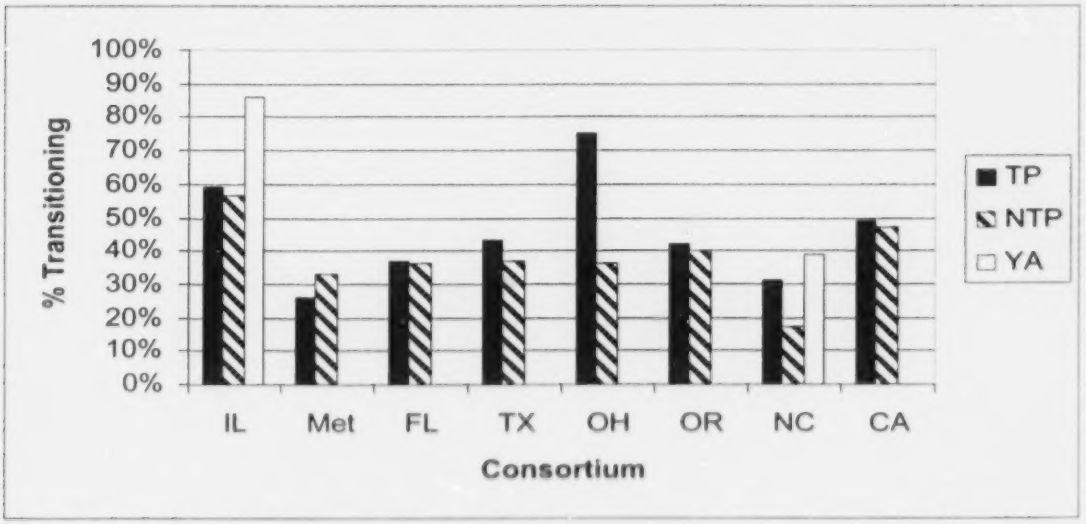

Figure 4. Percentage of Tech Prep, Non-Tech Prep, and TP/YA Participants Attending Two-Year College by Consortium

Results reveal interesting student transition patterns involving four-year college enrollment. For example, in the Metro and Guilford consortia Tech Prep participants showed a high level of matriculation to four-year college. Figure 5 shows the percentage of each group that matriculated to four-year college. (Individuals combining two- and four-year college are eliminated from this figure.) In both of these consortia more Tech Prep participants entered four-year than the two-year level, and fairly large percentages of non-Tech Prep participants entered four-year college as well. (Recall that the main postsecondary institution engaged in the Metro consortium is considered a four-year college because it awards bachelor's and associate degrees, contributing to the high matriculation to four-year college among Tech Prep participants in this consortia.) Results also show the higher enrollment of non-Tech Prep than Tech Prep participants in four-year college in the East Central, Hillsborough, Miami Valley, and Mt. Hood consortia. Comparable four-year college enrollment was observed for the two groups in the Golden Crescent and San Mateo consortia.

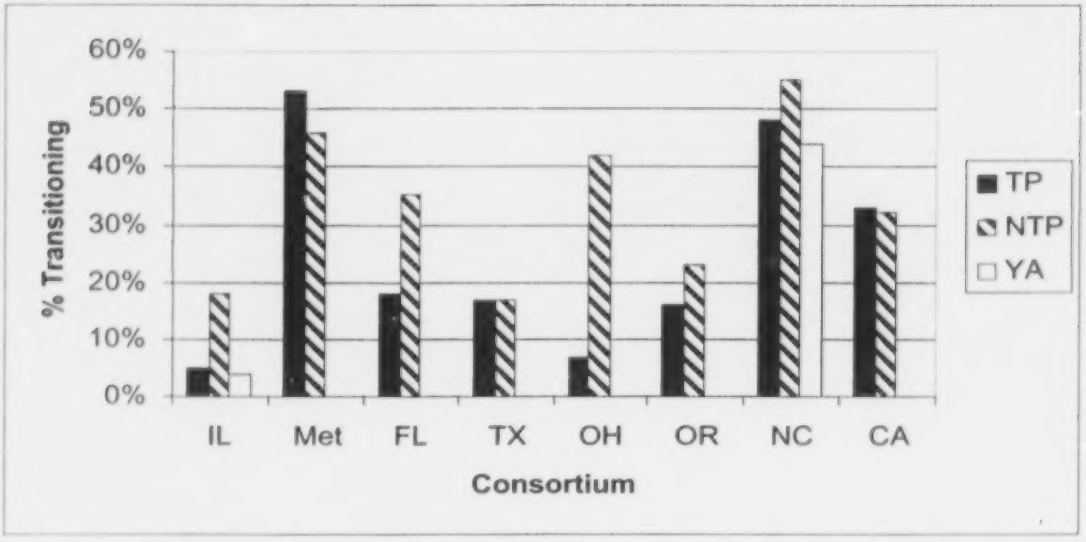

Figure 5. Percentage of Tech Prep, Non-Tech Prep, and TP/YA Participants Attending Four-Year College by Consortium

Though speculative, results suggest that different Tech Prep models may have different effects on student transition to college and work. Is it coincidence that Tech Prep participants who engaged in the College Tech Prep model in Guilford showed higher matriculation rates to four-year college than Tech Prep participants in other consortia? Only in the Metro consortium that emphasized college readiness to transition to the main four-year postsecondary institution did we observe as high a level of transition to four-year college among Tech Prep participants. However, in both of these regions a plethora of higher education institutions exist, making two- or four-year college very accessible. Further analysis is needed to uncover potential factors contributing to predominant transition patterns of Tech Prep participants pursuing different postsecondary education options within other consortia, such as the Hillsborough and Golden Crescent consortia which also offer the College Tech Prep option. Future analysis is needed to determine factors influencing student transition decisions, including student demographic characteristics, geographic location and setting, accessibility to various postsecondary institutions within the region and state, Tech Prep specialization (i.e., business, health, engineering technologies), and so forth.

Figure 6 displays the incidence of Tech Prep, non-Tech Prep, and TP/YA participants who worked without attending any sort of college within one to three years after high school graduation. Results on employment reveal that three consortia sent approximately 30 percent of Tech Prep participants directly to work without also engaging them in postsecondary education, and the incidence of work only among Tech Prep participants in these three sites far exceeded the non-Tech Prep group. This pattern was observed in the East Central, Hillsborough, and Mt. Hoot consortia. In the remaining consortia, an equal or greater percentage of non-Tech Prep

participants were working than the Tech Prep group, with only 15 percent or less of the Tech Prep participants displaying this behavior.

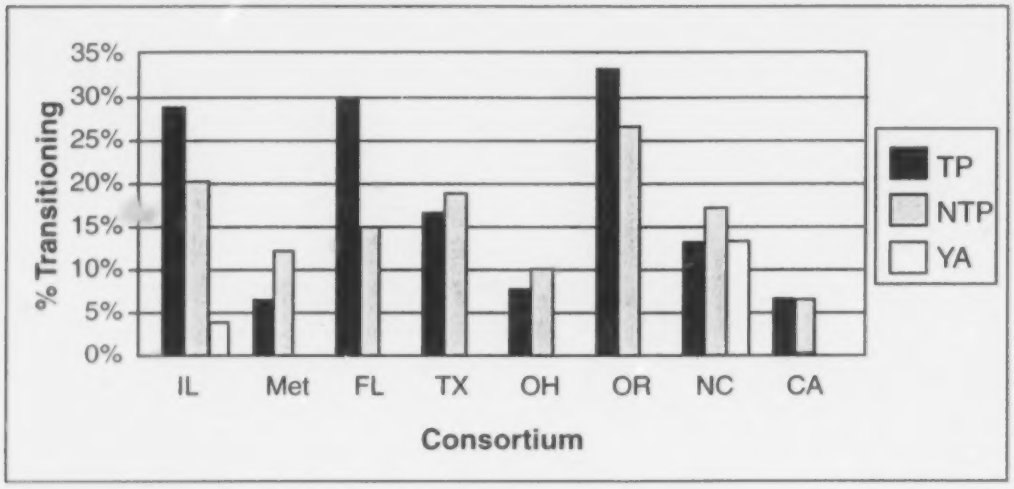

Figure 6. Percentage of Tech Prep, Non-Tech Prep, and TP/YA Participants Going to Work Without Attending College by Consortium

Survey results confirm that the vast majority of Tech Prep participants worked after high school while attending college, and they usually worked more hours per week than their non-Tech Prep counterparts. In fact, in four consortia over 90 percent of Tech Prep participants were employed, with more of these individuals working full-time than part-time. Whereas the majority of non-Tech Prep participants worked, a higher percentage of them worked part-time than the Tech Prep group. These results suggest the importance of understanding college attendance in relation to employment status. Students attending four-year college often enroll full-time while working part-time, but community college students frequently display the opposite pattern. Since Tech Prep and non-Tech Prep participation varies quite dramatically across sites, it is important for future analysis to closely examine these variables individually and collectively to discern relationships between Tech Prep participation, college enrollment, and post-high school employment. Without this more thorough examination, it will be difficult to ascertain the impact of Tech Prep participation on college and work.

CONSORTIUM RESULTS

Preliminary results from this study confirm the rich data source that has been created for understanding the Tech Prep experiences of students in divergent settings. Each case summary presented below provides an overview of local definitions of Tech Prep and particular implementation strategies involving key components such as academic and CTE integration, secondary-to-postsecondary articulation, WBL and other linkages to business, and so forth. In addition, the characteristics and experiences of high school students as they transition from high school to college and work is presented. In each individual case summary, student demographics and educational characteristics are reported, preliminary evidence of math and CTE high-school course-taking, college enrollment, and employment during and after high school are discussed.

The East Central Illinois Education-To-Career Partnership

The East Central Illinois Partnership is headquartered in Danville, Illinois, a community of approximately 50,000 residents that is situated in a rural area of the state. The consortium serves 12 high schools and one area vocational center (AVC) that are actively engaged in Tech Prep implementation. (Ten of the twelve high schools considered the most actively involved in Tech Prep were included in this investigation.) Danville Area Community College (DACC) has acted as the fiscal agent for the local Tech Prep consortium since 1992. For this consortium and the state of Illinois, the state agency having responsibility for administration of Tech Prep under Perkins III, the Illinois State Board of Education (ISBE), has defined a Tech Prep student as one who has made a conscious decision to follow a clearly defined sequence of courses to prepare for employment in a Tech Prep occupation, has declared Tech Prep as a major, and has an Individualized Career Plan (ICP) indicating a Tech Prep occupation as a career goal. A Tech Prep occupation requires an Associate of Applied Science (AAS) degree or two-year apprenticeship as the predominant method to enter the occupation, has the potential for above average entry wages and growth, requires advanced technical skills, and also requires multi-faceted problem-solving and critical thinking skills. A Tech Prep sequence of courses must include integrated academic and technical content, workplace skills, and instruction delivered both at the worksite and in the school/college setting.

Our field work determined that the vocational Tech Prep model is used widely by the high schools in this consortium, based mostly on a 4+2 model although there is limited use of the 4+2+2 approach. Additionally, the Tech Prep/youth apprenticeship (TP/YA) model is used in this consortium, and it is considered the premier means of implementing Tech Prep as it offers a comprehensive, structured model for a selected group of students.

Local Implementation

Local business involvement has played a critical role in the East Central Illinois consortium's implementation. Local businesses were particularly active and vocal partners in the consortium by encouraging WBL opportunities for students and actively supporting the youth apprenticeship program. Businesses also helped to strengthen professional development of faculty by providing work-site learning opportunities that extended well beyond one-shot workshops. Key stakeholders attributed progress in the implementation of Tech Prep to the numerous collaborative relationships that emerged between the community college, DACC, the high

schools and businesses. Local consortium leaders spoke often about how business support provided the leverage to make needed changes in the schools.

Perhaps because of the local concern for workforce development, WBL flourished in this consortium, mostly through youth apprenticeships. As support from educators and businesses grew, the workforce development and related WBL foci of the initiative matured. Over time, the educational system focused on linking school-based learning (SLB) and WBL, attempting to solidify the relationship between the two. As a result, some educators at all levels came to view education as synonymous with workforce development. In fact, several teachers indicated that the consortium leadership encouraged all teachers to consider themselves as Tech Prep teachers and to play a major role in preparing students for work.

Partly because of the TP/YA program, this consortium dedicated significant portions of Tech Prep and STW, known locally as Education-To-Careers or simply ETC, to WBL. Curriculum change was not perceived to be as significant for other high school students as for those engaged in Tech Prep because of the priority placed on TP/YAs, an option that attracted students who were sometimes already college-bound. In fact, efforts to develop a general Tech Prep curriculum were difficult to launch in several schools in a particularly cohesive or comprehensive way because of the predominance of the college prep curriculum. Even in a rural area reporting relatively modest percentages of students matriculating to four-year college and weak attachments to educational reforms focusing on advanced academics, the college prep curriculum dominated within high schools. Further, limited joint planning time was a major barrier to making curriculum changes in the predominantly small, rural high schools where it was impractical to isolate students for specific initiatives like Tech Prep, even if school officials wanted to do so, and most did not. Still, in some high schools applied academics courses were supported, and students were enrolling in them while also taking vocational courses. Most often this course-taking pattern was observed of students attending the area vocational center (AVC) and participating in the TP/YA program.

Curriculum change at the postsecondary level was undertaken through a collaborative approach involving local administrators, faculty, and businesses. One DACC administrator described curriculum reform as emphasizing more flexibility by designing Tech Prep programs to meet specific competency requirements for various local businesses. Likewise, ongoing participation of business and industry and increased levels of support in curriculum-related professional development activities created a synergistic effect. Key stakeholders confirmed that input to DACC from business and industry partners was stronger after the implementation of Tech Prep, and this level of input had a positive impact on other CTE programs offered by the college.

In terms of articulation agreements between the local high schools, the AVC and DACC, the consortium had placed only modest emphasis on course-to-course or program-level articulation. More recently the consortium was working with schools to develop dual credits in some CTE areas; however, because DACC imposed a limit of six hours of articulated credits on matriculating high school students there was limited emphasis on articulation. Repeatedly school personnel commented on the lack of incentive to create new articulation agreements since students were limited in their ability to get college credits at DACC. Moreover, anecdotal evidence suggested few students had taken advantage of articulated credits associated with Tech Prep.

The tight connection between Tech Prep and CTE was somewhat problematic for this consortium, because some stakeholders perceived both as predominantly focused on low-wage, low-skill jobs. Some of the greatest challenges came in marketing the Tech Prep initiative to parents, community members, and some academic faculty who preferred more traditional approaches to curriculum and instruction. Still, some stakeholders suggested Tech Prep had a significant impact on reforming CTE, because they believed Tech Prep played a role in enhancing its image and quality. Once primarily a high-school only program, CTE now included a postsecondary focus and that was a positive change. Faculty indicated other important changes as a result of Tech Prep, noting that a higher caliber of student was attending the AVC, called "VOTEC", and the curriculum included more academic and SCANS competencies. Teachers across the consortium also indicated that academic and CTE faculty interacted with each other more frequently and productively, and their interaction enhanced students' educational experiences. However, high school student perceptions of the AVC remained mixed; with few exceptions recent graduates had more positive perceptions than current students.

Recognizing the merits of the TP/YA program, recently this consortium sought ways to engage more high school students in educational experiences comparable to those offered by the TP/YA program. Knowing that such a comprehensive WBL program could not be sustained for a large number of students, consortium leaders sought to expand contextual learning to more classrooms in the high schools and DACC through the adoption of career pathways (consistent with the adoption of career pathways by the state of Illinois). This strategy was intended to help infuse more real-world problems into academic and CTE classes so that students would engage in SBL that is more applicable to life and work experiences outside of school. In the Fall of 1998 consortium leaders supported the adoption of career pathways as a means of encouraging student participation in Tech Prep. Since that time guidance counselors within each school have created documentation to explain the career pathways to students and parents.

Student Outcomes

Since this consortium does not treat the general Tech Prep initiative as a special program, Tech Prep students are *not* labeled. To identify Tech Prep students, school personnel used the local (which corresponds to the state) definition that specifies that a Tech Prep student is one who has made a conscious decision to follow a clearly defined sequence of courses to prepare for employment in a Tech Prep occupation. TP/YA participants must meet this definition, but additional criteria are used in the selection into the TP/YA program, including good attendance, disciplined behavior, and at least average academic performance. In contrast to the Tech Prep initiative where distinctions are downplayed, the TP/YA program is in the limelight in the high schools, with the "youth apprentice" label used freely to describe participants.

Using the lists of Tech Prep participants supplied by the high schools, a sample was drawn for the East Central Consortium. The number of Tech Prep participants in 1995 was extremely small, causing us to drop this group from the analysis altogether, with the exception of four youth apprentices who were included with the 1996 graduate panel. For the 1996 and 1997 panels, all Tech Prep high school graduates were arrayed according to class rank percentile separately by high school, and a random sample of about 260 was drawn ensuring that this group was reflective of the total population of Tech Prep participants in each school by graduation year. Once the Tech Prep sample was drawn, a sample of non-Tech Prep participants was selected at random from the same high schools using the same upper and lower limits on class rank

percentile as the Tech Prep group, ensuring a comparable distribution on class rank at high school graduation.

The entire population of youth apprentices in 1995, 1996, and 1997 was selected for the study because this group was small, representing a total of 37 youth apprentices for all three years. In fact, at the time the initial sample of Tech Prep participants was selected, the youth apprentices and Tech Prep participants were grouped together. Later when field visits confirmed that the educational experiences of the youth apprentice group were substantively different from the Tech Prep group, we separated the youth apprentice and Tech Prep groups for data analysis purposes. When this was done, a difference in class rank percentile and cumulative GPA became evident between the groups, with the non-Tech Prep and youth apprentice groups showing slightly higher academic performance than the Tech Prep group.

Student Demographics. The majority of students were White, with very few African-Americans or Hispanics represented in the entire school population. With respect to gender, Tech Prep participants were fairly evenly divided, however more youth apprentices were male than female, though the group had become more gender balanced in recent years through a concerted effort to attract more females into the manufacturing apprenticeship programs. The majority of graduates in all three groups (Tech Prep, non-Tech Prep, and youth apprentice) indicated their fathers either finished high school only or had some college but no degree. The education level of mothers was similar across the groups, though the mothers of youth apprentices were more highly educated than the other groups.

Compared to non-Tech Prep and youth apprentices, Tech Prep participants came from lower income families. About 30 percent of Tech Prep participants came from homes with a family income of less than $30,000 compared to about 20 percent of the non-Tech Prep group and 15 percent of the youth apprentice group. In terms of academic performance during high school, Tech Prep participants' class rankings were lower than youth apprentices, with most Tech Prep participants (63 percent) being in the middle two quartiles of their high school graduating classes (25th to 75th percentile) compared to the majority of youth apprentices (63 percent) having a class rank in the 51st to 75th percentile.

Secondary Course-Taking. Results show about two-thirds of the Tech Prep and youth apprentice graduates started the high school math curriculum below Algebra 1, with most youth apprentices starting with basic Applied Math courses. Looking at the highest level of math taken, over 40 percent of the youth apprentices and 50 percent of the Tech Prep participants completed Algebra 2 or more advanced math (e.g., trigonometry or calculus). Non-Tech Prep participants started and ended the math curriculum at a slightly higher level, but the difference was not statistically significant. The vast majority of graduates in all three groups took high school CTE classes, with Tech Prep and youth apprentices more heavily represented in these courses than non-Tech Prep, particularly in areas closely identified with Tech Prep and youth apprenticeships. Youth apprentices were more likely than the other two groups to have taken one or more technical/communication courses such as manufacturing technology, precision production (e.g., electronics), general labor market courses (e.g. work experience, career exploration), and specific labor market courses such as coop, reflecting the core curriculum of the youth apprenticeship program.

Post-High School Transition. Follow-up survey results for students show transition to college was similar for Tech Prep and non-Tech Prep participants in that the vast majority (about 70 percent) went to some type of college within one or two years after high school graduation. Two-year college was the overwhelming choice of students in all three groups, with youth apprentices more likely than either the Tech Prep or non-Tech Prep participants to transition to college, with nearly all matriculating to DACC. After high school, most Tech Prep participants and youth apprentices were employed full-time, while just under half of the non-Tech Prep participants were employed similarly. These results suggest Tech Prep and youth apprentice students were more likely to be working while also attending college than the non-Tech Prep group. Also, youth apprentices held their primary job longer than members of the other two groups, and more youth apprentices held jobs that required higher level skills.

The Metro Tech Prep Consortium

The Metropolitan Tech Prep Consortium is located in a large metropolitan area in the United States. (The specific location and identity of this consortium is not revealed in accordance with an agreement made by our research team with local officials to maintain the site's anonymity.) Within the consortium there are 15 urban high schools ranging in size, demographic make-up and curricular focus. One technical college providing two-year and four-year college degrees serves as the fiscal agent and primary transition site for graduates of the two high schools selected for this study.

In this consortium, a Tech Prep student is defined as any student in Grade 11 or 12 who is enrolled in Tech Prep math and Tech Prep English courses, who participates in a technical career cluster, and who expresses an intent to matriculate into the postsecondary Tech Prep curriculum. While in high school, Tech Prep students complete a series of classes having integrated academic and vocational content. Besides the sequential math curriculum, the high schools infuse math concepts into the technical curriculum. An English class is team taught by a high school teacher and college English instructor, and it is titled "Great Thinkers in Science", certainly a unique title for a senior-level English class. Although articulation is not as prominent a feature of Tech Prep as curriculum integration, the primary approach to articulation is 2+2, with some 2+2+2 programs evolving.

Local Implementation

Since its initial implementation, the Metropolitan Consortium has embraced five goals. One, to increase high school student awareness of, and access to, technical education and technical careers. Second, to increase the depth and coordination of technical education with secondary and postsecondary schools in the region. Third, to accelerate student progress through the associate degree by linking curriculum across grades eleven to fourteen. Fourth, to increase the collaboration between high schools, CTC, and local industry and facilitate the education and placement of qualified technicians. Finally, a fifth goal is to increase the retention of high school students at CTC. Over time, the consortium staff has sought to meet these goals by emphasizing several main components, especially interdisciplinary approaches to academic and vocational integration, secondary-to-postsecondary transition, and professional development opportunities for high school teachers, college faculty, and local administrators.

In pursuing the consortium's five goals, Tech Prep has emphasized a 2+2 or 2+2+2 articulated curriculum in technical areas, focusing on high school students as juniors and/or seniors who completed Tech Prep math and Tech Prep English courses. The math component included sequential math classes that infused math skills into the technical curriculum, and the Great Thinkers in Science class, which is actually a high school senior-level English class team-taught by high school and college instructors. Evolving in 1994, the Great Thinkers curriculum provides a model for the development of several other Great Thinkers courses and additional project-based academic and vocational integrated courses in the region.

Reflecting on the efforts of the Metropolitan Consortium, several key components developed to an advanced stage over the period of this study. For instance, since the early 1990's the recruitment process had evolved substantially, beginning initially at the middle school level and developing at the high school level where students could sign a Tech Prep contract and counselors could conduct orientation sessions so that students could learn about CTC, the lead college in the Metropolitan Consortium. Various transition activities helped students move from the high school to the college, including workshops designed to help students fill out financial aid applications. The consortium offered various WBL experiences such as internships, paid work placements, and school-based enterprises. Career guidance activities included visits to colleges, work sites, and in-school visits from working professionals. Finally, the priority for professional development and curriculum integration was reflected in the numerous curriculum development workshops and institutes conducted by consortium leaders, including the Great Thinkers courses, a benchmarking project with local university professors, and the consortium's six-year participation in an Urban Schools Network.

Consortium leaders believe that having a strong classroom experience helps to drive the maturity of the overall Tech Prep initiative. By targeting much of the Tech Prep grant funds for professional development for teachers, and, most importantly, by following up and creating the conditions for teachers to apply the new knowledge and skills to curriculum development, the consortium has made steady progress. Professional development has been the key to curriculum development and subsequent implementation of integrated curriculum, giving consortium leaders confidence that they have had a fighting chance at institutionalizing Tech Prep for the long term. Having committed leaders and involved teachers willing to engage in curriculum reform has been absolutely key for Tech Prep to take root in this consortium.

Student Outcomes

The consortium defines a Tech Prep student as any junior or senior who was selected as part of a recruitment process and participated in a minimum of Tech Prep math and Tech Prep English courses, a technical career cluster and transition to college activities. The math component includes sequential math classes offered at the high school; however, basic math skills are also infused into technical curriculum. A sizeable proportion of Tech Prep participants of the two high schools participated in the "Great Thinkers" course during their senior year, providing them with an opportunity to engage in an integrated course designed to ready them for college-level instruction. As a key part of Tech Prep, consortium leaders have emphasized numerous interdisciplinary approaches to academic and CT education, secondary-to-postsecondary transition, WBL, and professional development.

A random sample of 317 Tech Prep participants was selected for the Metropolitan Consortium study by an external evaluator who worked with the consortium. Using the consortium's database, a sample of Tech Prep participants was identified from the two high schools having the longest history with Tech Prep implementation in the consortium. Another elite, selective-admission high school that had begun Tech Prep implementation in 1992 was omitted from the study because the schools' efforts and student population were not viewed as indicative of the overall Tech Prep initiative in the region. Of the remaining high schools, none had been involved in Tech Prep implementation long enough to have high school participants graduating by 1995 or 1996, the graduation years of panels of Tech Prep students identified for this analysis. Once the group of Tech Prep participants was identified, a comparable sample of non-Tech Prep participants ($n = 326$) was selected at random from the same high schools using the same upper and lower limits on CRP, ensuring an equivalent distribution on class rank.

Student Demographics. A fairly high percentage of participants (38 percent) in Tech Prep were drawn from the top quartile of the high school class, but more than half were in the middle two quartiles. Most Tech Prep participants were minority (mostly African American), and a slight majority were female. The non-Tech Prep group was distributed similarly on race and gender. Nearly 60 percent of the Tech Prep participants indicated that the highest level of education experienced by their fathers was high school, and nearly 60 percent said that their family income was under $30,000. Non-Tech Prep participants reported similar responses on the follow-up survey regarding parental education and family income.

Secondary Course-Taking. Nearly half of Tech Prep participants took five to six semesters of math, and most others had taken seven or more semesters, an increase of 30 percent from the 1995 panel to the 1997 panel. The non-Tech Prep participants also increased math course-taking during this period, but not as dramatically as the Tech Prep group. By graduation, an equal percentage of Tech Prep and non-Tech Prep participants (15 percent) had taken advanced math (e.g., trigonometry and calculus). Both Tech Prep and non-Tech Prep participants took a great deal of CTE education, with nearly all having taken more than one CTE course and many having taken at least one course beyond the introductory level. Areas that drew the most students from both groups were business, health, and technical/communications, although Tech Prep participants were more likely to have enrolled in sequential courses in health and technical/communications than their non-Tech Prep counterparts.

Post-High School Transition. According to follow-up survey results, nearly all students had enrolled in some form of postsecondary education after high school graduation, with only 6 percent of the Tech Prep and 11 percent of the non-Tech Prep participants indicating they had not enrolled in college at all. Over 50 percent of the Tech Prep and 46 percent of the non-Tech Prep participants reported going to a four-year college only, with smaller percentages of each group (about 30 percent) going to a two-year college only. When asked about their current primary jobs, the majority of Tech Prep and non-Tech Prep participants reported that they were working, but over one-third of both groups reported that their jobs were part-time. Whereas 1995 high school graduates earned higher hourly wage and had higher skilled jobs than later high school graduates, participants in all groups tended to be employed in low wage (less than $6.00 per hour), unskilled jobs.

The Hillsborough Tech Prep Consortium

The Hillsborough Tech Prep Consortium is located in a large metropolitan area serving urban, suburban, and rural schools in Tampa and Hillsborough County, Florida. In total, 19 high schools and Hillsborough Community College with four campuses compose the consortium. The consortium defines a Tech Prep student as any student who has completed by Grade 11 at least one technical course in an articulated program of study and two courses each of English, science, and mathematics at specified levels identified by the state. A Tech Prep course of study consists of an articulated sequence of technical courses taken during the final two years of high school and the two years of postsecondary education (2+2) leading to an Associate of Science (AS) degree. Since Tech Prep students are identified in Grade 9 and are required to complete certain levels of courses in order to enroll in Tech Prep programs of study by Grade 11, the Tech Prep approach is considered to be a 4+2 (6-year) articulated program with some 4+2+2 programs available. While this initiative can be considered vocational Tech Prep, a College Tech Prep option is also available for students who take the college prep high school curriculum. The career academy model has also been used as a means of implementing Tech Prep, particularly in the area's technical high schools. Some CTE core course sequences provide dual credit, and some programs offer the time-shortened approach.

Students engaged in Tech Prep are counseled to create an individualized program of study that fits the Tech Prep curriculum specification, but they are not labeled as Tech Prep students or treated special. This practice is encouraged to avoid concerns that the Tech Prep label could surface around the tracking issue. Besides the curriculum emphasis, Tech Prep in this consortium also involves a concerted effort at professional development for faculty and counselors, career guidance, and marketing.

Local Implementation

A primary goal of the Hillsborough Consortium is to improve education and work opportunities beyond high school for all students, but especially for the neglected majority. The consortium seeks to accomplish this objective by replacing the general education track with Tech Prep curricula and by putting into place an articulation process that fosters transition. The connection that binds the secondary and postsecondary levels together for students is the articulated program of study and the Gold Seal Scholarship that provides financial support for Tech Prep high school graduates entering the community college. The STW initiative contributes to the objectives of Tech Prep by emphasizing raising academic standards, reducing the dropout rate, improving career guidance, and increasing WBL opportunities.

To accomplish its objectives, the consortium has emphasized three closely related components: career guidance, professional development, and marketing. Early in the initiative the Hillsborough Consortium focused on the professional development of guidance counselors and faculty, emphasizing the role these individuals could play in facilitating students' career and educational decisions and encouraging them to consider a career that requires preparation through a Tech Prep program of study. More recently the consortium has spent considerable effort in marketing both Tech Prep and STW in the lower grades and recruiting students as early as the eighth grade. (Pre-high school efforts are undertaken with STW funds.) Business and industry has also contributed to the training and development of faculty and counselors and to an increased emphasis on career awareness for students from the elementary grades through the

community college. Local and state evaluation has been a predominant factor in this consortium, and evaluation results obtained through surveys of students, parents and employers have been used to improve programs.

Efforts at integration of curriculum have taken place most readily between language arts and health, engineering, and culinary arts. Applied academics courses have shown positive results, but, in recent years, these courses have been replaced with standard academic courses supplemented with contextual learning strategies. In fact, results from this study suggest applied academics course-taking peaked during the 1995-96 academic year, and faculty have had difficulty implementing more advanced integration strategies. Some notable effects have begun in recent years with one high school offering career academies and others using career clusters to organize an integrated curriculum approaches. Also in recent years, the Hillsborough Consortium has supported integrated curriculum at the postsecondary level using the model of learning communities. At the secondary level, the consortium has replaced high school applied academics courses with contextual learning infused into traditional classes.

Student Outcomes

Students engaged in Tech Prep in this consortium are counseled to create an individualized program of study that fits the Tech Prep curriculum specification, but they are not labeled as Tech Prep students or treated as though they are part of a special program. Besides the curriculum emphasis, Tech Prep also involves a concerted effort at professional development for faculty and counselors, career guidance, and marketing.

The sample for the Hillsborough Consortium was selected by an institutional researcher employed by the Hillsborough School District, based on specifications that we provided. The sample was identified using a computer program that sorted students into Tech Prep and non-Tech Prep groups based on an algorithm created to replicate the high school academic and CT course-taking requirements specified locally for Tech Prep. Once the Tech Prep participants were identified, they were arrayed according to CRP separately by high school, and a random sample of approximately 300 was drawn, ensuring that the sample was reflective of the total population of Tech Prep participants in each school and by graduation year. A comparable sample of non-Tech Prep participants was selected at random from the same high schools using the same upper and lower limits on class rank percentiles as the Tech Prep group.

Student Demographics. A slight majority of Tech Prep participants were female and over two-thirds were members of minority groups, with a fairly even split of minority students between African American and Hispanic. About one-third of the Tech Prep participants indicated the annual income of their family was under $30,000 compared to about one-fifth of the non-Tech Prep group. A little more than half of the fathers of Tech Prep participants had received a high school diploma as their highest educational attainment, compared to about one-third of the non-Tech Prep group, whose parental education was higher. With respect to academic performance in high school, over one-third of the Tech Prep participants finished in the top quartile of their high school graduating class with slightly more than 50 percent finishing in the 51st to 75th percentile. By design, non-Tech Prep participants were distributed similarly on CRP.

Secondary Course-Taking. To be considered a Tech Prep high school graduate, completion of Algebra 1 was a requirement. When STW was incorporated into the local initiative in 1996 and 1997, students in this study were completing high school, so key elements of STW such as career guidance and WBL were not fully developed. Given this context, we learned that Tech Prep students did not take as much math as their non-Tech Prep counterparts, but most did complete three years and Algebra I. Whereas Tech Prep students did not reach as high a level of math as non-Tech Prep participants, more than one-half reached the Algebra 2 or more advanced level. Later panels of Tech Prep students were taking more math courses than earlier ones, suggesting that more were surpassing high school graduation requirements specified by the state. At the same time, Tech Prep participants were taking more CTE courses than their non-Tech Prep counterparts, especially in areas such as business, health, mechanics/repairers, and precision production.

Post-High School Transition. Follow-up survey results showed that a large percentage of participants of the Tech Prep and non-Tech Prep groups transitioned to college, with at least 70 percent reporting having attended some type of postsecondary institution within one to three years of high school graduation. Two-year college was chosen as a postsecondary option by over one-third or more of both groups, and enrollment in four-year college was very prevalent. Still, more Tech Prep high school graduates chose to go to work without transitioning to college than the non-Tech Prep group. Nearly 30 percent of the Tech Prep group (compared to only 15 percent of the non-Tech Prep group) had not yet enrolled at any postsecondary institution. With respect to employment after high school, the significant change in wages between high school graduation to the current job was evident for both groups, with approximately 40 percent of the 1995 Tech Prep and non-Tech Prep panels reporting a $5.00 or more positive change in wages since their primary high-school job.

The Golden Crescent School-To-Career/Tech Prep Partnership

The Golden Crescent Tech Prep/School-To-Career (TP/STC) Partnership includes seventeen public school districts (with a total of 18 high schools), a regional career center, Victoria College (VC), and an upper-division campus of a state university that shares the campus of VC. Following the state's requirements in this consortium, a Tech Prep student is defined as a student in Grades 9-12 who follows an approved Tech Prep high school plan of study leading to postsecondary education and training and is enrolled in courses appropriate to that plan. A postsecondary Tech Prep student is one who declares a major leading to an AAS degree that is state-approved as Tech Prep. Occupations identified as Tech Prep occupations are those that have been targeted by a regional quality workforce committee, indicating they meet a higher standard of skill level and higher wages. The consortium's primary articulation approach is based on the 4+2 model, consisting of a high school core curriculum of grade-level or above academic courses, combined with a coherent sequence of career and technology courses of at least three and one-half credits, in addition to the AAS degree curriculum at the postsecondary level. Some 4+2+2 programs have also been developed. Dual credit, with enhanced or advanced skills curriculum, is available to students in articulated courses.

Local Implementation

The Partnership's approach to Tech Prep implementation is based on the identification of existing high school CT courses, or the addition of state-approved CT courses not previously

offered, with content that aligned with courses taught at Victoria College. These alignment activities are conducted by joint secondary and postsecondary subject-area faculty, resulting in an articulation agreement and competency profile. The courses are then identified in an articulation agreement that outlines criteria for award of college credit and a six-year curriculum plan that serves as a road map for course-taking at the high school and college levels. These six-year plans are based on the state's "recommended college-preparatory plan" for high school graduation which includes a coherent sequence of CT courses. Articulated courses are identified in the high school portion of the plan, and the college counterpart is also identified.

When approved by the state as Tech Prep, students selecting the six-year plans can be reported to the state as Tech Prep students, though this designation is not used within local high schools to avoid the stigma that labeling sometimes engenders. At the postsecondary level, AAS degrees affiliated with six-year plans are officially identified as Tech Prep, though students in these programs are not designated as Tech Prep students either. Preferring an approach that does not track students into a particular program, the Partnership considers its Tech Prep model multiple-entry/multiple-exit to encourage participation by students considering various post-high school options, including four-year college. By using a multiple-entry/multiple-exit approach, students who take articulated courses at the high school level do not have to repeat them at the college level, whereas students entering the college-level Tech Prep program without articulated credits have to take all courses in the college-degree plan.

Various strategies have been employed by the partnership to support and enhance the articulated curriculum associated with Tech Prep. The partnership has encouraged the use of contextual learning strategies and the integration of academic and CT competencies through professional development workshops for faculty and by purchasing supplemental curriculum materials. Though teachers have not been encouraged to create separate applied academics courses, changes in classroom instruction have been recommended to make learning more engaging and relevant to the work world. Also, faculty have been encouraged to integrate workplace experiences with their classes, ranging from business/industry tours and guest speakers, to job shadowing, cooperative (co-op) education, clinical experiences, apprenticeships, and internships.

The partnership has also offered a variety of activities to enhance career guidance and counseling activities among partnership members, but the extent of implementation of career counseling has been uneven. Individual high schools and Victoria College have determined the extent to which career guidance and counseling is offered, leading to a great deal of variation across the consortium. To bring about greater consistency, the partnership offered a variety of professional development activities for counselors on career plans and career portfolio development, and sponsored career fairs and related student activities. Publication of marketing and career information materials has supported guidance staff, but the extent of use of these materials or their impact on student selection of Tech Prep and related career pathways has been limited.

Overall, the inclusive nature of the partnership's governance and membership structures has facilitated the implementation of Tech Prep and related STW activities. Victoria College has played a pivotal role in the partnership and the development of workforce education programs for the region. The dual role of the partnership as the developer of regional labor market information has added to the cohesion of the partnership and the goal of implementing Tech Prep

and related activities to prepare the workforce to meet regional economic needs. Yet, the size and rural nature of the partnership has made it difficult for the high schools to implement a large number of articulated courses, restricting student opportunities to courses commonly offered in other localities in the state, for example, computer courses included in business-related programs.

Student Outcomes

The sample of approximately 300 Tech Prep high school graduates in 1995, 1996, and 1997 was drawn randomly using lists of names supplied by six participating high schools in the consortium. The six high schools were identified purposively because they were thought to be the most representative of the entire group of 18 high schools in the consortium in terms of their approach to Tech Prep implementation and the diversity of their student populations. Also, these six high schools had begun implementation of Tech Prep in the early 1990s, providing them with sufficient time to have graduated their first group of Tech Prep students by 1995. Four of the high schools were small rural schools, providing approximately one-half of the sample of students for this analysis. The remaining two schools were much larger and located in the largest community in the consortium. From these two schools, the remaining half of the sample was drawn based on the local definition of a Tech Prep student. Once the Tech Prep graduate sample was drawn, a random sample of about 300 individuals was drawn from a group of 1995, 1996, and 1997 non-Tech Prep participants from the same six high schools, ensuring a comparable distribution on class rank at high school graduation.

Student Demographics. Within this consortium, over 40 percent of the Tech Prep participants represented minority groups, primarily Hispanic, and non-Tech Prep participants were similarly distributed on race/ethnicity. Slightly over half of the Tech Prep participants were female whereas the non-Tech Prep group was evenly distributed on gender. About half of the Tech Prep participants had fathers who had finished high school but pursued no further education, similarly to the non-Tech Prep group. Nearly 30 percent of the Tech Prep participants came from families having less than $30,000 annual income. Overall, the families of non-Tech Prep students had somewhat higher income than Tech Prep students, but 34 percent indicated having family income under $30,000. Most Tech Prep participants in this consortium were in the middle two quartile or above on class rank percentile. Overall, 60 percent of Tech Prep participants were from the middle two quartiles, with another 26 percent in the top quartile of the high school graduating class, and a comparable non-Tech Prep graduate group was selected for the analysis.

Secondary Course-Taking. Looking at math course-taking, most Tech Prep and non-Tech Prep participants took more than five or six semesters of math, exceeding the minimum high-school graduation requirement of three years set by the state. In fact, just over one-third of both groups had taken seven or more semesters of math. Over the years investigated, Tech Prep participants took progressively more math courses, with the level of math taken by 1997 graduates significantly higher than the 1995 graduates. Among 1997 Tech Prep participants, nearly 70 percent had taken Algebra 2 or more advanced math such as trigonometry or calculus (including AP courses) by the time they graduated from high school.

In terms of CT course-taking, nearly all students had taken at least one semester of CT education during high school in traditional vocational areas, typically business, agriculture, and

consumer and family development (CFD) or vocational home economics, with business being the most popular option. Tech Prep participants were also more likely to have taken a sequence of business courses than the non-Tech Prep participants. Even so, high levels of CT course-taking were not evident for either the Tech Prep or non-Tech Prep group. Leaders explained that minimal CT course offerings in the small rural high schools combined with raised graduation requirements and 6- or 7-period days limited students opportunities to take CT courses. Combined with the low prestige of some vocational education programs, CT course-taking was not being encouraged by high school counselors, and students were limiting their participation in it.

Post-High School Transition. Most high school graduates continued on to postsecondary education after high school by attending a two-year college. In fact, over one-half of all students had transcripted credits with Victoria College, with a higher percentage of Tech Prep participants having college transcripts at Victoria College compared to the non-Tech Prep group. Only 17 percent of the Tech Prep and non-Tech Prep students had enrolled in four-year college only, but nearly another 20 percent had attended both two- and four-year colleges. Finally, less than 20 percent of either group had finished high school and gone directly to work, bypassing college altogether. Current employment status revealed that 40 percent of Tech Prep participants were employed part-time and another 40 percent were employed full-time. In terms of wages, about 60 percent of the Tech Prep graduates earned between $5.26 and $7.00 per hour, and a similar percentage of non-Tech Prep graduates were making equivalent wages. Most graduates affiliated with the Tech Prep and non-Tech Prep groups described their jobs as entry level/unskilled; however, between 20 to 24 percent of each classified their occupations as skilled or technical.

The Miami Valley Tech Prep Consortium

In this large consortium headquartered in Dayton, Ohio, sixty-four comprehensive high schools feed into three vocational centers or high schools (comprising eight vocational education planning districts), one community college, a small business college, and a four-year university. Sinclair Community College (SCC), located in downtown Dayton, houses the consortium office and employs the local Tech Prep consortium director. Through a strong working relationship between SCC and the three vocational high schools, Tech Prep programs are implemented that serve many of the feeder high schools in the region.

In alignment with the state definition, Tech Prep is a relatively selective program. Compared to traditional CTE programs, Tech Prep poses greater academic demands on students, particularly in mathematics and science, and provides a comprehensive technical foundation rather than mastery of particular technical skills. Within these parameters, a Tech Prep student is one who is enrolled in a state-sanctioned Tech Prep program, beginning in Grade 11 and continuing through the Associate degree in the CTE and employability competency delivery system.

According to the local consortium, and consistent with the Ohio Department of Education, a Tech Prep program participant at the secondary level is a student who is in Grade 11, has completed a Tech Prep application, has enrolled in articulated CTE programs, and is enrolled in or has taken at least one applied academics class. The consortium defines a Tech Prep graduate as a student who has followed an approved Tech Prep curriculum pathway and has earned an

Associate degree with an advanced skills certificate. Because of its extensive components and targeted approach, this consortium's approach is classified as a comprehensive, structured Tech Prep model. It also fits the specifications of the original Tech Prep Associate Degree (TPAD) model proposed by Parnell (1985) quite well. The 2+2 and 2+2+2 articulation models are supported by agreements known as memoranda of understanding, which allow for advanced skills articulation as well as dual enrollment.

Enrollment in Tech Prep has been kept low intentionally to ensure that the quality of programs is high. (In fall 1997, just under 4 percent of all eleventh and twelfth graders were identified as Tech Prep students.) A selective admission process reinforces the consortium's focus, emphasizing that Tech Prep is a program designed for students of average academic ability or above who maintain good attendance and a positive attitude toward school. To become a Tech Prep student, high school students have to be nominated by teachers and counselors, and they have to enroll in articulated CTE programs of study and applied academics courses during the eleventh and twelfth grades. Students who complete the secondary Tech Prep program, continue on to the lead community college, and maintain academic eligibility during college (i.e., a 2.25 GPA overall) are eligible to receive a Tech Prep scholarship, entitling them to $1,000 per year for at least two years of collegiate studies at SCC immediately following high school graduation, as long as they continue to meet academic requirements. The Sinclair Community College Foundation is the sponsor of the Tech Prep scholarship.

Local Implementation

Tech Prep is viewed locally as a broadly defined technology program for students who seek postsecondary education, including at least an Associate degree, in a technical field. Tech Prep programs of study include a focus on combined academic and technical training at both the secondary and postsecondary levels. With some variation in the local high schools and CTE centers, the consortium offers the following six Tech Prep programs: allied health, automotive, computer support, and electronic, environmental, and industrial engineering technologies.

A driving feature of the state of Ohio's Tech Prep curriculum is industry-driven skills and competencies, and the local consortium has made a firm commitment to implementing the state's model. Local business and industry leaders assist in creating the list of all necessary competencies required for a Tech Prep graduate to enter a particular job within an occupational cluster. Faculty then develop and offer curriculum based on these competencies, providing an array of courses ranging from introductory to advanced skills at both the high school and community college levels. Courses are sequenced based on the specific outcomes of a joint curriculum development process.

The consortium has identified six features of its Tech Prep program that are considered essential: competency-driven curriculum and career pathways driven by industry (mentioned above); strong articulation agreements to link the educational institutions; highly esteemed professional development initiatives; efforts on the part of all institutions to support a seamless transition to other schools or work; a state-driven strategic plan; and Tech Prep scholarships offered by SCC. The consortium has overcome challenges throughout the implementation process, particularly in the areas of release time for professional development and funding to support curriculum development, which is very extensive each time a new technical area is identified as a focus of Tech Prep.

Since 1996, Tech Prep funding has been performance-based and linked to a statewide evaluation process emphasizing increased enrollments, low remediation rates, quality collaborations, and effective professional development. In addition to performance-based funding, the consortium has benefited from a large multi-year grant from the National Science Foundation (NSF) in the area of Advanced Technology Education (ATE) to develop a new Associate degree program for engineering technology students; support professional development and curriculum development; and enhance innovative instructional practices including contextual learning; and hands-on training.

The consortium has put several programs in place to support the continued professional development of faculty and staff. For example, across the consortium schools develop a detailed plan and sign an agreement to pay for substitute teachers while faculty participate in professional development activities including the Teachers in Industry for Educational Support (TIES) program that partners teachers with business and industry employees. In addition, the annual winter symposium attracts academic and CTE faculty as well as counselors and administrators from throughout the region. We witnessed several hundred teachers in attendance at this particular event in December, 1998.

Student Outcomes

Sampling was done by a local leader of one of the CTE centers who was involved in Tech Prep administration at the time. He was selected for this task because of his close association and long history with high school personnel, primarily guidance counselors, in the region. Using procedures prescribed by our staff, this local official identified a random sample of Tech Prep participants from two area vocational centers (having 14 feeder high schools with at least 10 Tech Prep participants per school) and one comprehensive high school that offered its own Tech Prep program. These schools were chosen because of their long-standing affiliation with the local Tech Prep consortium.

Once the sample of Tech Prep students was drawn, a sample of non-Tech Prep participants was selected, but limited access to student records from feeder high schools complicated selection of non-Tech Prep participants. While it was possible to include a non-Tech Prep participant group in this analysis, it was not possible to obtain a complete set of transcripts for non-Tech Prep participants or to ensure the comparison group was as similar on GPA or CRP as in other sites engaged in this study. Therefore, readers are urged to use caution when comparing Tech Prep and non-Tech Prep participant groups in this consortium due to the systematic differences inherent in the two samples at the outset.

Student Demographics. Students enrolled in Tech Prep in participating schools in the Miami Valley Tech Prep Consortium were primarily White, with only about 10 percent representing a minority group. The racial composition of this group was comparable to the overall student population in largely suburban and rural high schools at the perimeter of the consortium, the area from which most Tech Prep students were drawn. Had more urban high schools been engaged in Tech Prep, the student population would have been more diverse, as one would expect of this large metropolitan area.

With respect to gender, nearly three-quarter of the Tech Prep participants were male whereas the non-Tech Prep participants were evenly balanced between male and female. The dominance

of technical education in areas such as automotive and various engineering technologies continued to be dominated by male students, as they were historically. Most female students were enrolled in the health curriculum, an area heavily dominated by females though some male students were observed in the program.

About one-half of the Tech Prep participants indicated that their fathers had finished high school or less education, but non-Tech Prep participants' fathers were more highly educated. Only about one-third of non-Tech Prep participants said their fathers had not gone on to any kind of postsecondary education. About 20 percent of the Tech Prep participants had family income under $30,000 compared to 16 percent of the non-Tech Prep group.

Secondary Course-Taking. Looking at academic performance during high school, Tech Prep participants were fairly evenly distributed in the top three quartiles of CRP with only 15 percent in the lowest percentile. By comparison, nearly all the non-Tech Prep students were between the 25th and 75th percentile on CRP, with 60 percent in the 75th to 50th percentile. Tech Prep participants started at lower levels in the high school math curriculum than their non-Tech Prep counterparts, but they advanced to about the same level, with 70 percent completing Algebra 2 or even more advanced math by the time they finished high school. Tech Prep participants were much more likely to have participated in applied math courses than non-Tech Prep students, but these courses did not limit students' advancement to more advanced math courses. Tech Prep students participated in CTE courses in health, technical/communications, mechanics/repairers, and general labor market classes, all courses associated with specific Tech Prep pathways. Except in business and consumer and family studies, Tech Prep participants were more likely to have enrolled in technical specialty courses (the most advanced technical classes offered by the secondary schools) and engaged in sequential enrollment in technical courses than their non-Tech Prep counterparts.

Post-High School Transition. Based on follow-up survey results, approximately 90 percent of students in the Miami Valley Consortium matriculated to some type of postsecondary education. Nearly 75 percent of the Tech Prep group went to college at SCC, with another 10 percent matriculating to a combination of a two- and four-year college. By comparison, only about one-third of the non-Tech Prep group enrolled at SCC, but over 40 percent had gone to a four-year college. Only 10 percent or less of either group had gone directly to work without attending some form of postsecondary education within one to three years of high school graduation. When completing the follow-up survey in the fall of 1998, the majority of the Tech Prep and non-Tech Prep groups were employed, both during and after high school graduation. Employment after graduation was often full-time, though wages were typically low, even for those in full-time positions. However, it was encouraging to learn that 1996 Tech Prep graduates experienced significantly higher wages than 1997 graduates. Their hourly wages averaged between $6.01 and $10.00 while working in entry-level, semi-skilled or skilled/technical jobs, with about 40 percent of the 1996 group making over $10.00 per hour. (This pattern was not evident for the non-Tech Prep group.)

The Mt. Hood Regional Education Consortium

The Mt. Hood Regional Education Consortium is made up of one regional educational service district serving seven suburban high schools in a large metropolitan area of the Northwest. The consortium is headquartered at the Mt. Hood Community College, and a postsecondary proprietary school situated in the community is also part of the consortium.

A Tech Prep student in this consortium is defined as a student who chooses, in Grade 11 or 12, to enroll in a major course of study in one of the 2+2 Tech Prep programs. These programs are linked to two-year AAS degree programs at the local community college. A Tech Prep course of study is defined locally as an integrated program of academic and CTE (referred to as CTE studies locally) designed for students in Grades 11 and 12 and further postsecondary education. A Tech Prep program includes standard courses needed for a high school diploma plus electives that provide students with technical preparation for the given Associate degree program. The Tech Prep Associate Degree (TPAD) can include advanced or dual credits in either academic or CTE courses.

Local Implementation

Development of the Tech Prep curriculum was influenced heavily by not only what was happening at the local level, but also the state. The Oregon Department of Education, state officials, and representatives from the school districts made a substantial investment in the management and evaluation of Tech Prep to coincide with educational reforms advocated throughout the state. At the local level, the high schools provided the opportunity for members of local communities to take part in the decision-making process, and the state's reform initiative highly encouraged this activity. High schools, in turn, encouraged parents and members of the community to actively participate in site council meetings, open houses, information nights, parent meetings, and other committees that worked actively to create opportunities for planning, implementation, and evaluation of Tech Prep (and subsequently STW) at the local level. According to the consortium coordinator, the relationship between the state and local decision-making bodies provided a more complete picture of the needs and achievements of various related reform initiatives.

The consortium set three goals for Tech Prep and they were to ensure that students would acquire a good foundation for an associate degree, certificates, or college credits; advance into the first year of college without having to repeat course work; and be able to advance in their college programs. The consortium used Parnell's model as its guide as it established Tech Prep associate degrees, but over time, with passage of related reforms such as STW and heightened concern for raising academic standards for all students, the consortium's target population for Tech Prep became less clear. Still, it seems most students who chose Tech Prep were doing so as an alternative to the university/college preparatory curricula.

Emphasis was placed on a number of key components by this consortium. First, articulation of CTE classes, dual credit and advanced placement was encouraged, even though small percentages of students had taken advantage of articulated credits. Moreover, greater emphasis was placed on the articulation of academic courses, particularly for the neglected majority population. Second, core curriculum increasingly relied upon career pathways, guided by state policy that encouraged a standard set of career pathways for the entire educational system. In

this consortium, some career pathways had fallen into place quite easily, but others had been challenging, and further work was needed to make all the career pathways viable in the schools. Third, consistent with the state's reform of high school certification, consortium officials worked diligently to link Tech Prep and STW to the Certificate of Initial Mastery (CIM) and Certificate of Advanced Mastery (CAM), and related academic standards. Changes in core curriculum having to do with mathematics were evident in the high schools as more students were being encouraged to achieve higher levels of mathematics.

Success in acquiring state and federal funds to develop and implement various initiatives related to CTE, STW, and workforce development assisted this consortium with its goals, although management of competing goals and accountability requirements of funding streams was burdensome for local consortium leaders. Partly due to the mixing of multiple, compatible goals, a few years ago this consortium elected to change its name to an "Educational Consortium," dropping the Tech Prep and STW distinction altogether. Examining the impact of the various initiatives, a heavy emphasis on professional development emerged, focusing on linking curriculum reform to raise standards and infuse more academic and CT integration.

Student Outcomes

Sample selection for this consortium was conducted by local education officials, using a computerized database maintained by the state and regional education offices. A total sample of 263 Tech Prep students was selected for the study, and these students were 1995, 1996, or 1997 graduates of one of three high schools in the consortium. The three high schools were chosen because they could identify Tech Prep enrollees and, more importantly, they had provided adequate information to the regional office to be able to flag Tech Prep students. Other schools in the consortium had not yet developed this capacity, suggesting the schools identified for this study were potentially more engaged and committed to Tech Prep implementation than the norm.

The sample for this consortium was based on the following definition of a Tech Prep student: Tech Prep students were those who had enrolled in a 2+2 Tech Prep program and earned a minimum of two credits in CTE courses during the junior and senior years. The academic component of the Tech Prep student's course of study was not specified, although Tech Prep students were encouraged to take integrated academic and CTE studies, including applied academics. Tech Prep students were not labeled as such and little special attention was brought to Tech Prep in the schools. Students may or may not have known that they were considered a Tech Prep student.

Once the Tech Prep sample was drawn, a similar sample of non-Tech Prep participants ($\underline{n}$ = 269) was selected at random from the same high schools using the same upper and lower limits on CRP as the Tech Prep group, ensuring a comparable distribution on CRP at high school graduation.

Student Demographics. Results showed the majority of Tech Prep participants were in the middle two quartiles of their graduating classes on CRP, with another 15 percent above the 25th percentile and 20 percent below. About 40 percent of the Tech Prep participants were female, with only 15 percent representing a minority group. By comparison, non-Tech Prep participants were slightly more likely to be male and minority. With respect to the education level of parents, 40 percent of the Tech Prep participants indicated that their fathers had a high school diploma or

less, and 26 percent indicated their family income was under $30,000. Focusing on non-Tech Prep participants, the education level of fathers and family income was slightly higher than for Tech Prep participants.

Looking specifically at math course-taking behavior, students in this consortium started math at a variety of levels, with about one-third of Tech Prep participants starting below Pre-Algebra, about another one-third starting with Pre-Algebra, and about the same percentage starting with Algebra 1. By comparison, non-Tech Prep participants were starting at a higher level in the math curriculum, with 32 percent starting math with Pre-Algebra and 42 percent with Algebra 1. Results regarding highest math course taken showed a similar pattern, with non-Tech Prep participants advancing slightly higher in the math curriculum than Tech Prep. However, it is important to point out that the 1997 Tech Prep graduates were ending at higher points in the math sequence than the 1995 Tech Prep graduates. By 1997 the math course-taking pattern of Tech Prep participants was comparable to non-Tech Prep participants with 29 percent of the 1997 Tech Prep participants taking Algebra 2 or more advanced math, compared to only 14 percent of the 1995 Tech Prep group.

Secondary Course-Taking. With respect to CTE course-taking, more Tech Prep participants were enrolled in CTE specialties and also more were enrolled in sequential courses within CTE areas, including precision production, mechanics/repairers, technical/communications, and consumer and family studies, than the non-Tech Prep group. A very high percentage of both the Tech Prep and non-Tech Prep groups took business and specific labor market courses (e.g., co-op, work experience), with the latter area explained by the fact that the high schools required a career exploration course for all students. In terms of employment, approximately 80 percent of the Tech Prep and non-Tech Prep groups worked during high school in part-time jobs offering minimum wage.

Post-High School Transition. Taking into account survey responses, the majority of graduates continued their postsecondary education at the two-year college level. Almost half of the Tech Prep and non-Tech Prep participants had transcripted credits with the Mt. Hood Community College (MHCC), with a higher percentage of Tech Prep participants having college credits at MHCC than the non-Tech Prep group. More Tech Prep participants had gone directly to work bypassing college as compared to non-Tech Prep, though over one-quarter of each group had chosen this path. Most graduates were employed when responding to our follow-up survey one to three years post-high school, and most reported that their current primary job was in an entry-level/unskilled or semi-skilled position. However, Tech Prep participants tended to maintain employment in their primary job longer than non-Tech Prep participants, proving a plausible explanation for why Tech Prep participants had also experienced a significant positive change in wages from high school to current employment.

The Guilford Tech Prep Consortium

For this consortium, Tech Prep (known locally as College Tech Prep) has served as a means of replacing the general education curriculum, and providing students with a strong academic foundation and technical skills. The core academic degree requirements for Tech Prep are similar to those for College Prep, with the exception that a Tech Prep course of study requires students to complete four sequenced technical courses as electives, and these courses substitute

for the foreign language requirement. Students who complete the core Tech Prep curriculum in high school are considered College Tech Prep (CTP) completers.

In addition to its CTP program, this consortium also supports a vital TP/YA program that includes eleven youth apprentice options. Each apprenticeship is based on the same core components of two years of College Tech Prep course work in high school, followed by a two-year AAS degree program at a two-year college (often with a scholarship), combined with paid work experiences with sponsoring businesses. This consortium uses a 2+2 approach to articulation, providing advanced standing credit and concurrent enrollment. The consortium is located in Guilford County, North Carolina, serving the Guilford County school district consisting of 14 high schools and one area vocational center. The Guilford Technical Community College (GTCC) serves a county-wide constituency. In contrast to several other consortia involved in this study, the county school district serves as the fiscal agent for the Tech Prep grant. Schools in this consortium are highly diverse, ranging in size and geographic location from urban to rural.

Local Implementation

The Guilford Consortium has made systemic school reform, K-14 system-building, and extensive WBL the center pieces of its Tech Prep and STWOA initiatives. The consortium has built extensively on the state's early priority for a College Tech Prep (CTP) course of study, supplemented with a solid commitment from local business and industry to the youth apprenticeship model. The school district and college, both individually and collectively, have worked over the past six years to revamp vocational-technical education with a significant youth apprenticeship component, establish technical skill-based employment as viable career options, and combine high academic standards with thoughtful career planning for all students.

The county's K-14 workforce development system combines many of the recommended strategies of Tech Prep and STW. This shared system established career pathway courses of study in the high school, created articulated career pathways between the secondary schools and community colleges with youth apprenticeship opportunities, supported extensive integrated and applied curriculum development, established an extensive career development process, and reformed vocational-technical education through upgraded labs and equipment, standards-driven curriculum, and broad-based business and industry oversight and advisement. The school district's adoption of High Schools That Work (HSTW) helped to reinforce its own goals to foster higher academic achievement for all students while strengthening and extending vocational education. The shared commitment of the school district and community college to using national standards and the Developing a Curriculum (DACUM) process has guided program development and articulation in several vocational-technical areas.

The approach to Tech Prep implementation used by the school district and community college has been systemic in nature, combining professional development, and a phased-in implementation process, particularly among the high schools. The school, college, and other council members established a series of joint study groups, some for high school staff (on the use of item banks, for example), some for both the community college and school district staff (on WBL), and still others combining community college, school district, and business and industry on each career pathway. These study groups investigated the reform strategies, identified standards and models, and proposed strategies to be used throughout the county. These study

groups also helped to sort out the local implementation challenges and supported local adoption of the various reform strategies.

The strong and committed leadership of the community college president, the school district superintendent, and business and industry enabled the formation of a partnership that has been crucial to establishing shared goals. Through this collaboration, the partners have expanded strategies to improve the skill level and quality of the county's entry-level workforce and provide youth with multiple career and educational options. While the school district and community college have encountered some implementation challenges, they have continued to look for opportunities to incorporate complementary strategies by adding new career development strategies K-14, expanding career pathways and youth apprenticeship options, and improving programs of study, marketing materials, and curriculum.

The CTP program of study and broader K-14 workforce development system are still under development, reflecting a long-range commitment. Both the school system and the community college, as well as the other partners, are continuing to enhance and expand the various elements, including extending career development activities, expanding into new career pathways, upgrading the vocational-technical courses of study, and integrating academic and technical instruction. Often, however, these efforts have focused within each institution and less attention has been directed to the students' transition between the school system and community college. The community college's publication of courses of study for eleven career paths helps to clarify the 2+2 sequence. More guidance is needed, however, to facilitate students' planning for 2+2 courses of study.

Student Outcomes

Tech Prep and non-Tech Prep students selected for this study graduated from six of the fourteen high schools in the consortium. The six purposively chosen high schools were the first to implement Tech Prep during the initial planning years of 1993 and 1994; with remaining high schools following in subsequent years. Consequently, all high school graduates (n = 373) who had completed the four-year high school course sequence of CTP in 1996-98 were included in the analysis. These students were the first to complete the CTP curriculum, which stressed the integration and completion of higher level academic and CT courses and multiple educational and career options. To be counted as a CTP completer and therefore included in this study, students must have completed four years of English, three years of math at the Algebra 1 level or above, three years of science, and four sequential credits (the equivalent of two years) of CTE by the time they graduated from high school. Students identified for this analysis were flagged by the local school district's institutional research office based on an audit of high school transcripts.

The youth apprenticeship program had more restricted eligibility than CTP, with different admission requirements for each technical program. As with Tech Prep participants, all youth apprentice graduates were included in the analysis, especially since this group was quite small (n = 39). It is important to note that students who engaged in the TP/YA program were more readily identified with that program than CTP, partly because of the selective admission requirement and special program features. At a minimum, the TP/YA programs required a 2.0 GPA and good attendance. To be counted as a youth apprentice high school completer

(graduate), students in youth apprenticeship programs must have completed the CTP course plan requirements as well as the specific apprenticeship program requirements.

Once the CTP and youth apprentice groups were identified, a comparable sample of non-Tech Prep participants was selected at random from the same high schools using the same upper and lower limits as the Tech Prep group, ensuring a comparable distribution on CRP at high school graduation. Results show that the youth apprentice group had a significantly higher CRP and cumulative GPA than the Tech Prep and non-Tech Prep groups. Since the TP/YA group was quite small requiring that we take the entire population, it was not possible to control for GPA or CRP in the selection process. This information should be considered when examining the subsequent discussion of student outcomes.

Student Demographics. Slightly over half of the participants in this consortium were female, and nearly 50 percent were members of a minority group, primarily African American. By comparison only 33 percent of the youth apprentices were female, and 43 percent were members of a minority group. Non-Tech Prep participants were distributed similarly to the Tech Prep group on gender and race/ethnicity. Just over 50 percent of the Tech Prep participants indicated that their fathers had finished high school but pursued no further higher education, compared to about 40 percent of the youth apprentice and non-Tech Prep groups. Moreover, nearly three times as many Tech Prep participants reported their family income under $30,000 as the non-Tech Prep group as compared to 20 percent of the youth apprentices.

Secondary Course-Taking. About 70 percent of the Tech Prep group was situated in the 26th to 75th percentile on CRP, with about 20 percent in the top quartile and 10 percent in the bottom. Youth apprentices were even more represented in the top two quartiles, with 72 percent having a CRP at that level. The high school and community college experiences of 1996-1998 graduates reflect the early stages of implementation of Tech Prep. Results for Tech Prep, non-Tech Prep, and youth apprentice participants show that the majority of all three groups had completed seven or more semesters of math courses in high school; 1998 high school graduates took more math than previous groups. Tech Prep and youth apprentice graduates were even more likely than non-Tech Prep to have completed Algebra 2 or more advanced math, and youth apprentices were the most likely of the three groups to have completed the most advanced math. About half the graduates from all three groups completed at least one honors math course during high school. In terms of CTE, both Tech Prep and youth apprentice graduates were more likely than their non-Tech Prep counterparts to be enrolled in CTE, and to be taking sequential courses in such areas as business, marketing, health, and precision production (e.g., electronics, drafting, machine shop).

Post-High School Transition. Though difficult to know for sure based on initial follow-up survey results, after high school, Tech Prep and youth apprentice graduates appear to be more likely to be working in jobs that required specialized skills that they would have learned in CTE courses during high school as compared to non-Tech Prep participants. Given their advanced academic preparation, it is not surprising that the vast majority of graduates in all three groups enrolled in postsecondary education at a two-year or four-year college, with less than 17 percent of any of the groups choosing to not go to college within one to three years after high school graduation.

The consortium's emphasis on college preparation could be a factor in the high transition rate of Tech Prep participants to four-year college. Approximately half of the Tech Prep and non-Tech Prep groups (48 percent and 55 percent, respectively) attended a four-year college or university within one or two years after high school graduation, with 5 percent more having attended both a two-year and four-year college. Slightly less of the youth apprentice group transitioned to four-year college than the other two groups. However, youth apprentices (39 percent) and Tech Prep participants (31 percent) were more likely to attend a two-year college than non-Tech Prep participants (17 percent). Slightly higher percentages of non-Tech Prep (17 percent) than youth apprentice and Tech Prep participants (13 percent each) indicated they had gone directly to work and not enrolled at any postsecondary institution, within one or two years after high school graduation. 1996 high school graduates tended to earn higher wages per hour ($8.00 or more) than later high school graduates regardless of Tech Prep status. However, Tech Prep and TP/YA participants were slightly more likely to work in semi-skilled or skilled/technical jobs more than non-Tech Prep participants.

The San Mateo Tech Prep Consortium

The San Mateo Tech Prep consortium is located in a major metropolitan area on the west coast of the United States. The consortium includes a large county made up of 19 predominantly suburban high schools (with a few urban high schools) and one community college district consisting of three community colleges. Tech Prep students are identified by this consortium when they have completed an articulated vocational course in high school that is part of a Tech Prep program of study. A Tech Prep course of study includes a sequence of related courses within a specific technical area designated as Tech Prep. Thus, the articulation component is the driving feature of Tech Prep in this consortium. Articulation agreements between high schools and the three community colleges in the consortium provide dual credit or advanced placement articulation options for students in vocational courses. The 2+2 model utilized for Tech Prep seems to follow the pattern of vocational Tech Prep identified by Hershey et al. (1998).

Local Implementation

Tech Prep implementation began in 1992-93 for separately funded consortia associated with each of three community colleges in the county. However, in 1996-97 the three consortia joined together into one to form the San Mateo Consortium. Since the beginning, Tech Prep has focused primarily on articulation agreements for vocational classes, and Tech Prep students were identified by their completion of articulated vocational courses and receipt of Tech Prep certificates. When students matriculated from high school to community college, their Tech Prep certificates acted as a sort of "proof of purchase," indicating to the college that the student had mastered the skills and knowledge offered in a secondary-level vocational (Tech Prep) course.

Since implementation of STW, called School-To-Careers (STC) in the state of California, in 1997-98, there has been a deliberate attempt to align the goals and activities of Tech Prep with those of STC. Similar to Tech Prep, STC has included an emphasis on ensuring that career pathways were available to eleventh- and twelfth-grade students. According to the 1998-99 Tech Prep grant application, restructuring high schools into eight career pathways was a major goal of STC. In fact, Tech Prep and STC worked together to bolster vocational articulation via the development of career pathways to support the seamless transition of students to any of the three

community colleges in the county. The two initiatives shared common objectives in that they emphasized strengthening relationships between education providers and STC; integrating academic and vocational competencies, WBL experiences, and SCANS skills; continuing to enhance professional development; providing support services for students; and increasing industry involvement in Tech Prep.

Without doubt, articulation agreements were a key ingredient in the formula for Tech Prep in this consortium. Articulation agreements plus the adoption of applied academics courses and later career pathways constituted much of the emphasis of the 2+2 core curriculum change efforts over the years. Professional development and changes in guidance and counseling served as catalysts for change in many county high schools. According to local administrative personnel, Tech Prep has been widely accepted at some high school sites, particularly those in north and south county districts, and somewhat less accepted at the mid-county schools, where strong emphasis on students pursuing professional jobs and four-year degrees was prevalent.

Initially, implementation of Tech Prep occurred through the use of articulation councils that met every two to three months. More recently, when much of the articulated curriculum has been put into place, these councils have met once or twice each year. The various curriculum integration committees (CICs), which report to the articulation councils, also met at least twice a year to develop, review, and update curriculum. These CICs were comprised of secondary and postsecondary faculty from relevant CT and academic disciplines.

Leadership of the San Mateo Consortium was assumed by a countywide coordinator of Tech Prep, who also served as the assistant chancellor of research and technology for the community college district, with responsibility for several funded programs, including Tech Prep. In addition to a consortium coordinator, all three colleges have hired their own part-time Tech Prep project directors who work with the local secondary district partners. At the local level, these project directors have worked directly with business advisory councils to oversee occupational program activities across the consortium. The regional occupational program director has also served the district schools and coordinated Tech Prep efforts through a variety of off-campus educational programs. At the school-building level, high school site coordinators have been responsible for planning Tech Prep and coordinating happenings in their schools with the countywide effort. Each college and its high school district have been served by an articulation council composed of administrative and faculty representatives as well as business representatives from all consortium partners.

This consortium has tied Tech Prep closely to CTE which is perceived to be declining. Tech Prep has had a hard time attracting teachers and students who affiliate more closely with college prep curricula, and applied academics courses have had difficulty attracting students. The specific identification of students to participate in Tech Prep has been problematic. This concern has been most evident in mid-county high schools where college prep is emphasized extensively. Modifying traditional curricula has been a problem, and limited funding and a lack of knowledgeable personnel have complicated the effort. Structural changes to school schedules have been slow to evolve. Finally, strategies to heighten and sustain business and industry involvement have been implemented, including engaging business representatives in curriculum development efforts.

While this consortium has faced a number of barriers in implementing Tech Prep, it has generated continued commitment by joining Tech Prep and STC into new career pathways, providing the opportunity to expand Tech Prep beyond the articulation of CT courses. In this region where the economy has flourished and high tech jobs have increased at a staggering rate, a continuing challenge will be to move the local Tech Prep initiative beyond a vocational Tech Prep model to a more comprehensive and systemic approach. Making this change will require a significant reorientation of high school, community college and university personnel. More importantly and more difficult, the change will require reeducating the community at large about the potential of Tech Prep to improving K-16 education while simultaneously meeting workforce demands.

Student Outcomes

Sample selection for this consortium entailed the acquisition of lists of all Tech Prep participants who completed high school in 1995, 1996, and 1997 in five high schools in the consortium, all located in the northern or central region of the county. Schools selected for the study had been involved in Tech Prep implementation since the early 1990s and were representative of the overall implementation strategies of the consortium. All students who had participated in Tech Prep and graduated in 1995-97 were selected for the study ($\underline{n} = 313$) since the population of Tech Prep participants approximated the desired sample size of 300. To create the sample, the lists of students were obtained from consortium and school officials, based on community college database records showing students who had participated in and later requested Tech Prep credits. Once the Tech Prep sample was identified, a similar sample of non-Tech Prep participants was selected at random from the same high schools using the same upper and lower limits on class rank percentile as the Tech Prep group, ensuring a comparable distribution on class rank at high school graduation. A total of 310 non-Tech Prep participants was selected as the comparison group for this study.

To understand who the Tech Prep participants are for this consortium, it is important to understand the particular local approach to Tech Prep implementation. Tech Prep has focused primarily on articulation agreements for CTE classes offered at the high schools and obtained Tech Prep certificates. Tech Prep participants have been encouraged to enroll in higher level academics using mostly traditional methods, since applied academics courses were not provided in most of the schools.

Student Demographics. Tech Prep participants in this consortium were fairly evenly split on gender, and the majority were members of minority groups, mostly Asian American and Hispanic. Non-Tech Prep participants were similarly distributed on gender and race/ethnicity. Almost one-third of the Tech Prep participants (compared to about one-fifth of the non-Tech Prep participants) indicated that their fathers had a high school diploma or less education. Less than 20 percent of the Tech Prep participants reported a family income under $30,000, and slightly over 10 percent of the non-Tech Prep participants reported a similar income level. Whereas about 50 percent of the Tech Prep participants finished high school with a CRP between the 26th and 75th percentile, another 33 percent was above the 75th percentile, thus in the top quartile. Only 14 percent were in the bottom quartile.

Secondary Course-Taking. The majority of students in both groups took a substantial amount of math, with about 20 percent completing at least Algebra 2 and another 40 percent

completing at least one advanced math course (e.g., Trigonometry or Calculus), suggesting Tech Prep and non-Tech Prep participants alike were moving to the advanced level of mathematics in the high school curriculum. With respect to CTE, almost all graduates participated in some CTE classes; however, Tech Prep participants took more. A higher percentage of Tech Prep participants took CTE courses in the areas of business, precision production, and mechanics/repairers than their non-Tech Prep counterparts. Tech Prep participants were also more likely to be taking a series of CTE courses than the non-Tech Prep group. Although new career pathways were not implemented fully at the time these students were attending high school, some Tech Prep participants were involved in courses that aligned with these pathways, including the computer information systems and business systems pathway and the industrial technology, construction, and engineering pathway. Each of these pathways provided matriculation opportunities to two-year colleges in the area and some students were taking advantage of them.

Post-High School Transition. According to the follow-up survey, Tech Prep and non-Tech Prep participants were very similar in their post-high school transition behaviors, with the vast majority proceeding to two- or four-year college (or a combination of the two). Students showed a very high rate of enrollment in postsecondary education, as indicated by the fact that 94 percent of both the Tech Prep and non-Tech Prep participants transitioned to some form of postsecondary education within one to three years of high school graduation. Approximately one-half of the students in both groups went to two-year colleges. Interestingly, slightly more Tech Prep students entered two-year colleges and four-year universities than their non-Tech Prep counterparts. Within one to three years of high school graduation, a very small percentage of students had gone directly to work without attending some form of postsecondary education at all. Wages for graduates in both groups were distributed over a wide range of earnings categories, with the largest percentage of Tech Prep graduates (18 percent) earning $7.01 to 8.00 per hour and the largest percentage of non-Tech Prep graduates (21 percent) earning $6.01 to $7.00 per hour. However, more non-Tech Prep (19 percent) than Tech Prep participants (8 percent) reported earning wages above $13.00 per hour. A majority of both groups held entry level/unskilled jobs at the time the follow-up survey was conducted in spring 1999.

FUTURE RESEARCH

This longitudinal research is important because, since passage of Perkins II in 1990, Tech Prep implementation has occurred, but its scope, depth, and impact is largely unknown. Numerous studies conducted during the 1990s focused almost exclusively on implementation (i.e., plans and processes) with minimal attention paid to outcomes. Beyond these few studies, no longitudinal research has been done. Moreover, the USDE-OVAE has not launched a subsequent national evaluation of Tech Prep and the National Assessment of Vocational Education (NAVE) has not commissioned an independent study of it either. This apparent lack of systematic evaluation of an initiative that is widely recognized as the largest scale and most directed effort to reform CTE (or vocational education) since the 1960s is disconcerting. Without federal support, studies of a national scope and scale are rarely undertaken, leaving questions about the efficacy and impact unanswered. As such, this study designed to continue longitudinal data collection on implementation and student outcomes associated with Tech Prep participation, heightening its importance to understanding the impact of Tech Prep at the local level.

Having created a useful baseline in terms of Tech Prep implementation, student demographics, secondary course-taking, and transition to college, further research is needed to examine particular policies and practices that encourage or impede student participation in Tech Prep in secondary education, but also the postsecondary level. Whether and how Tech Prep facilitates higher academic performance is an important question, and this study strives to examine this question for the Tech Prep and TP/YA groups over time since access to subsequent panels of Tech Prep high school graduates (1995, 1996, 1997 and in one case 1998) is possible.

Transition to college and work is probably the most central phenomenon of interest in this study, so we seek various ways to understand the behaviors displayed by Tech Prep, TP/YA and non-Tech Prep groups in leaving high school and entering postsecondary education or work, but usually both. Qualitative and quantitative data will be essential to understanding the decisions youths make in moving out into the world as young adults. Reliable estimates of Tech Prep enrollment at the postsecondary level are difficult to ascertain, but knowledge of student participation in the entire curriculum is essential to determining the success of Tech Prep. Our data set is uniquely capable of answering questions pertaining to transition to college and work. Questions also remain regarding student participation in new CTE specialties, and further analysis will be done to explore student involvement in these specialties, along with the impact of related support services, dual credits, scholarships, and so forth.

Without question, the governance and administrative structures that underpin Tech Prep can influence implementation and the eventual impact of Tech Prep on students; however, very little research has been done to examine this phenomenon. Having access to qualitative and quantitative data, as a part of this mixed-method study, we hope to make progress in uncovering relationships between consortium-level policies and approaches and student participation and outcomes. In addition, the complex roles played by business and industry as an advocate for, stakeholder in, and/or beneficiary of Tech Prep are relatively unknown. Much more needs to be known about how to leverage organizational change at all levels, particularly related to the complex roles played in educational reform by business and industry. While this study takes only a snapshot at these important questions, other researchers are encouraged to consider what we learn and pursue these questions more fully.

This research will also determine the extent to which Tech Prep participants enter college without remediation, and the extent to which they persist in college and complete degree programs, particularly Tech Prep (CTE) pathways. Future analysis of the data set will examine this phenomenon in much greater depth as we hope to be able to speak with some confidence about the relationship between secondary Tech Prep participation and postsecondary CTE enrollment, performance, and completion. Continuation in a Tech Prep course sequence, access to articulated or dual credits, and participation in WBL are additional factors that need to be studied, offering the potential for our results to yield valuable insights into the relationship between Tech Prep implementation and specific student outcomes at the postsecondary level.

Finally, further analysis using the data set obtained through this study can also help to answer questions about employment outcomes for students participating in Tech Prep, although the data set has some serious limitations in this area. Examination of questions about employment is dependent upon the follow-up survey, which yielded a moderate response rate in some consortia but a fairly low response rate in others. Ultimately, the data set may prove inadequate to yield conclusive results on employment outcomes. Still, we hope to uncover interesting patterns and generate important hypotheses that are central to future studies, including research utilizing nationally representative data sets that have the potential to reveal results explaining the relationships between Tech Prep, employment outcomes, and individual economic benefits. (Research beginning under the direction of James Stone of the University of Minnesota and Frankie Laanan of the University of Illinois at Urbana-Champaign under the auspices of NRCCTE may help to fill this gap.)

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